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Preface to Volume XXX

Ugly ducklings

There has been much talk recently of creating special schools or classes for eminent children. The argument runs somewhat as follows : the regular teaching is devised to suit the greatest number of children, that is, those of moderate aptitudes. It has already been realized that slow as this teaching might seem, it was much too fast for some children, in fact was entirely wasted upon them; and in the larger cities, special classes have been formed to take care of the backward pupils. It was not fair, indeed, to let the progress of the whole class be impeded by a few lame dogs. But even as there is a tail to each class, there is also a head,—a head which is as much in advance of the rest as the tail is behind. Is it fair to oblige the most gifted children to waste their time, waiting for the others to catch up ? If they could easily accomplish in five years what would take the others eight or more, why oblige them to throw these additional years away ? Could they not employ them to a better purpose,—to go further ? Why discourage them by such a slow pace, when they are able to go so much faster ? Let good teachers make the best of what is in them and carry them as far as they possibly can. Then those children are ready to go further still, and, taking off from such an advanced point, who can tell how far they will reach and, in their turn, carry us ?

The classes for backward children have fully proved their usefulness : they have made it possible to give some rudimentary instruction to children who did not succeed previously in obtaining any. But this success does not allow us to assume that classes for superior children would be equally successful. The tail and the head are essentially different and to conclude from the one to the other is obviously to draw a false analogy. For one thing the backward classes could do no harm, for the worst that

might happen was the failure to teach those children anything, and that is just what happened when they were left with the normal children. On the other hand, the good results obtained were very tangible : the backward children were taught something and the ordinary classes were freed from a dead load which handicapped them dreadfully and discouraged pupils and teachers alike. The other problem is infinitely more complex. Some good may perhaps be achieved by accelerating the pace of the quick, but the possibilities of evil are equally great. I am not a professional educator but I have given considerable thought to this special subject and have satisfied myself that, all considered, special classes for exceptionally intelligent children would do more harm than good.

My life-long endeavor better to understand the development of intellectual progress has obliged me to study carefully, among other things, the lives of some of the men who contributed most to that progress and, because of my interest in human genius, I have taken special pains to reconstruct, as much as I could, its origin and growth in many individual cases. There is nothing more fascinating than to consider the childhood of great men. Can the idle gestures of a child ever reveal anything of its future greatness? Among the innumerable actions which could not be distinguished in any way from those of other children, are there not some of a prophetic nature? I am sure there are a few, a very few, and it is a great joy to hunt for them, and maybe to find them, like rare gems hidden in a large mass of dross. And how did these children grow, how did they weather the many vicissitudes of childhood, of puberty and youth, the hopes and discouragements, the follies of early manhood? How did their genius develop within themselves, how did they become aware of its presence, how did it gradually dominate their whole life, how did they come to think what they thought and to do what they did? The examination of many such questions has given me some authority to deal with the great problem previously mentioned. Indeed one might say that I have made an experimental study of it, taking advantage of the experiments carried out by nature. Keeping in mind those very children, whose fate it was to fulfil the highest purpose of mankind, I have often asked myself, how would they have been helped by the existence of classes such as some of our latest pedagogues would like to estab-

lish, classes of rapid transit, we might call them. Would their progress have been easier, and, chiefly, would they have gone and taken us any further? I doubt it.

But before examining that question, another must be answered first. Is it possible at all to distinguish children of genius from others? I said that some of their sayings and doings are truly prophetic, but these are exceedingly rare and we do not generally understand their signification (or we cannot be sure) until they have been fulfilled. Who is going to select the pupils who deserve extraordinary care and are supposed to need rapid transit? It would take a prophetic vision and genius of the highest order to do it well. The main difficulty is to distinguish between extraordinary, but as yet undeveloped, intelligence and mere precocity. A young child may seem to be very intelligent because it has developed more quickly than others, but how shall we know whether he will be able to keep up for very long? And if he is not able to walk very far, what is the use of taking him there so early? It will all end in making us realize more promptly his mediocrity, and the ambitious hopes of teacher and pupil alike will soon give way to utter disappointment.

Precocity has no value and is hardly interesting. OLIVER WENDELL HOLMES used to say of infant prodigies that those who get up so early in the morning are likely to be very conceited all the forenoon and very sleepy all the afternoon. What does it matter that some children can do at ten what others will do only at fifteen, and that others can do at fifteen what others still would do only at twenty or twenty-five? What interests us is not how fast a child will go but how far it will go. There is no social need for speedy development, but there is a tremendous and constant need for exceptional achievement. The interest in precocity is of a very low order; it is in fact of the same order as the popular interest in monstrosities of any kind : a very precocious child, for example, a very young violinist will attract the public curiosity (and incidentally the public money) in the same way as the fat woman, the giant and the dwarf of our circuses. But who wants to establish classes for the creation of monsters? Leaving aside this mean curiosity, mankind has no concern in precocity. What signifies is the performance and not the age of the performer. For example, our sympathy may be

awakened by a very young composer, we may dream dreams with him and for him, but after all the main point is not to compose early but to compose unusually well, not to do at a very early age what most people can do only in their maturity but to do at any age what most people can never do.

It is very probable that educators having to select pupils for their special classes would all the time mistake precocious children for those endowed with real genius. They would easily be deceived because precocious children are generally very brilliant while children of genius are more likely to be even less brilliant than those of very mediocre aptitudes. This is fully confirmed by experience : many men and women of genius were very inconspicuous in their childhood, or if they were at all remarkable, it was rather for their queerness, dullness or excessive sensitiveness, than because of such external brilliancy as most people would appreciate. They were not beautiful birds but rather ugly ducklings. Teachers in charge of special classes would be more likely to select the most brilliant of the students than the most promising. And how could they discover genius, even if they had a good deal of it themselves, when real genius does more often than not ignore its own self?

Is there then no way of detecting the presence of genius before it is fully developed? I believe there is no sure method because what we call genius is not a definite aptitude but a very complex combination of many virtues and possibilities. People speaking of genius often pass from one foolish extreme to another : either they entertain a mystical notion of it or they affect to consider it as hardly different from mere eminence. Now we can of course define the words we are using to some extent as we please, but according to the general usage of many countries, when we speak of genius we mean the possession of qualities which are, if not essentially different from those of other men, at least of a different order of magnitude. In spite of some extravagance hero-worshippers bear witness to this; they realize instinctively that their heroes have done things which they could not have done themselves even if they had taken infinite pains. Genius is the fruit of an exceedingly rare combination of circumstances. It is not enough to have unusual qualities, one must have the economy of them; if these qualities harmonize, they strengthen and heighten

one another; if not, they weaken and even destroy one another and become of little avail. Any form of energy can be expressed by the product of two factors, one of which represents a potential, an intensity, the other, a capacity. Thus to take the simplest example, the energy of a waterfall depends upon the height of the fall and upon the amount of water falling. When a fall is dried up, however high it may be, it has no energy; on the other hand if the height is too small we do not expect much work to be done, irrespective of the quantity of water flowing. In the same way the highest form of human energy, genius, may be considered as the product of two factors : a potential, the ability to do new things or to do old things supremely well, and a capacity, the will to do them, the infinite patience, the indomitable zeal. Much misunderstanding is due to the fact that one often considers the first factor only. This is just as foolish as if we meant to measure the energy of a waterfall by its height alone. Thus one may sometimes hear a fond mother saying " My son has a real genius for this or that but the trouble is that he does not work or tires too soon." This is as ridiculous as if she said : " I have a powerful waterfall on my estate, but the trouble is that hardly any water is running..." Those who claim that genius is nothing but the ability to take infinite pains neglect the other factor and this is just as foolish as if they would measure the energy of a fall without paying any attention to its height. The two factors must always be considered together. No matter how great one of them is, it may be rendered ineffective if the other is sufficiently small. We all know instances of men who were exceedingly brilliant but lacked will power and steadiness and went to pieces. It is very tragic for themselves and for others to realize that they might have become great men, benefactors of mankind, that they had the intelligence, the originality, the experience which were needed, all of that in abundance, but unfortunately they had not the moral fibre, the iron character without which all the other qualities were as wasted. It is almost as pathetic to watch men whose strength of resolution and whose magnificent efforts are sterilized by the absence of originality.

There is still one third element to consider : purpose. Even as the energy of a waterfall can be used to attain various ends which are not equally good, even so the direction of human genius

may have been determined more or less happily. It is but too often misdirected, and continuity is then temporarily dangerous. However, in the majority of cases, the general and final direction of one's endeavor is settled rather early in life. Mediocre people or those who are merely brilliant may have considerable difficulty in finding their way : are not all ways almost equally good if one does not feel within oneself any special call, or—which amounts to the same thing—if one feels equally apt to do everything? It is those very people whose aptitudes are not differentiated who maintain the theory that any man is as good as another; the philosophy of the " just as good " is essentially the philosophy of mediocrity. But the more intense the genius within, the greater the probability that it will make itself felt, though it may be unconsciously, at a rather early stage. It is for that very reason that the study of the childhood of great men is so interesting. When did the little flame within begin to burn? When was the child first aware of it? It may begin to burn very early without anybody realizing it, not even its host. The progress of his vocation may then remain largely unconscious for many years : yet the flame grows and grows until the time comes that he cannot ignore it any longer. But many more years may still be needed before other people perceive it.

Now it is easy to understand that the child who has a real vocation—whether it be conscious or not,—whose mind is already focussed upon a definite object, is likely to be more concentrated, less brilliant, less attractive, less amiable than the one whose activities are not yet mortgaged and who can still smile and laugh at the whole world without afterthought. The selection among many children of those who may become great men (I do not say successful men) is thus very difficult, for if these are likely to be ugly ducklings, it does not by any means follow that every ugly duckling hides such wonderful possibilities. Yet some signs would not escape the attention of intelligent parents or teachers as soon as they had divested themselves of their prejudices and fully realized that, in the case of children too, all is not gold that glitters. There are various examples of such premonitions, but to me the most convincing are those which were prompted by awe rather than by pride or by the need of boasting. We can easily imagine the feelings of a sensible woman who had dreamed

that her highly gifted child would be some day rich and powerful, when it suddenly dawns upon her that all these dreams may be ruined by higher aspirations. Thus the good woman who was D'ALEMBERT's foster mother (soon after his birth he had been abandoned by his parents upon the steps of a church) used to say to him : " You will never be but a philosopher? And what is a philosopher? A fool who torments himself while he is alive in order that people may speak well of him when he is dead..." And the grandmother of EDWARD FORBES, the great Manx naturalist, an unlettered but very intelligent woman exclaimed one day : " I believe the whole Isle of Man cannot save this boy from being a fool." (1) Such sayings touch me deeply : they express the fear of good people who would naturally prefer comfort and safety to the risks of pioneering, in the presence of divine gifts which may be as heavy to bear as a cross. Would that more people had enough intuition to sense the presence of genius, even with anxiety, instead of being so blind and deaf to it that they tread it down mercilessly like wild animals trampling the exquisite little flowers of a pasturage. Would that childish genius be given plenty of unobtrusive opportunities and be left otherwise, as far as possible, to develop along its own line, instead of being repressed and dwarfed by unimaginative parents and impatient pedagogues. We cannot create genius but we can destroy it and, I am afraid, we often do destroy it, when we insist too much on conformity, on immediate results, on conventional standards.

An argument which is often brought forward in defense of special classes for supernormal children is that, if one gives them too meager a diet such as they would receive in ordinary schools, their minds will have too little occupation, they will become lazy and will fall into the habit of dreaming away a good part of their time. But who can say that such dreaming is really bad? May it not be on the contrary the cradle of the original ideas which will mould that child's life? Assuming that pedagogues could select the right pupils for their special classes, would they not risk overloading them and thereby make fertile dreaming

(1) Still another example. At the time of publication of the *Discours de la méthode* (1637), DESCARTES' father is reported to have exclaimed " Faut-il que j'aie mis au monde un fils assez ridicule pour se faire relier en veau !"

more difficult and jeopardize their opportunities of spontaneous development? And where would one find and how could one recruit teachers of sufficient genius to teach children of genius, to nurse such rare and delicate plants without hurting or stunting them? I ask once more, would the risks not far outweigh the advantages?

Think of those children dreaming dreams which nobody can guide in any way. Idle dreams at first, but all young dreams seem idle even as all young children seem foolish. Who can put his finger here or there and say, this is worth while and this is not? Some of these dreams at least are not idle and will gradually develop into definite thoughts, and some of these thoughts in their turn will become the directive forces of a long life. Said one of the greatest French poets : " Genius is a thought of youth fulfilled in later years." Even so ! The dreams go back to the earliest youth, even to the beginning of mental life, the thoughts crystallize later around them and in most cases the process is completed during early manhood. The history of science proves that most great ideas were conceived by relatively young men—men who were not yet thirty—, but it often took them a long life of absolute devotion to accomplish their purpose. Can we imagine any teacher trying to accelerate this process? What would be gained by that? The study of cases of genial precocity leaves one the impression that the fruits might have been still more valuable if it had been possible to retard the child's mental evolution so as to make it synchronize with a more robust physique and a more seasoned judgment. It would have been undoubtedly better for him, if his genius had not grown faster than his body and if his childish games and his youthful pranks had not been blighted by premature worrying. As that very acute observer, FRANCIS GALTON, remarked : " The highest minds in the highest races seem to have been those who had the longest boyhood." It is well known that early motherhood is unfavorable to both the mother and the child; it is very probable that the premature pregnancy of a mind is equally unwholesome.

Thus very far from trying to accelerate the mental process of an exceptionally gifted child, I would rather hold it back. It should be noted that a very intelligent child is likely to have a very intense, if lopsided, curiosity; he is likely to be overstimu-

lated; the mental assimilation going on all the time in his little mind, consciously or not, may be sufficiently serious to jeopardize a frail body, a body which is already perilously starved by its own growth. The parents' duty is then, very distinctly, not to increase the stimulation but on the contrary to assuage it, to protect as much as possible the developing body and soul. Let me repeat that time is relatively unimportant. The essential task of mankind is not a competition for speed, nor even for endurance, but simply for achievement.

And there is still this to be considered. The creation of classes for subnormal children was in any case a godsend for the normal classes which were thus relieved and purified; whatever the fate of the new classes might be, the old classes could not but be materially improved. The creation of supernormal classes would of course affect the schools in the opposite way. What would become of them, if their best elements, the most progressive children, the very leaven of each class, were systematically withdrawn? I believe that the average school provides an excellent environment for the supernormal child : the relative meagerness of the diet is no real objection, for the school is not by any means the only source of a child's experience; neither is the relative mediocrity without some advantage, for this may work as a much needed sedative.

One could not emphasize too much that what a gifted child needs above all is sufficient quietness. Excessive teaching may be useful but it is more likely to be pernicious. How could anybody assume to guide that child when nobody can yet know whither it is bound? It is wiser to permit his own nature to develop as soundly as possible, giving it unobtrusively every good opportunity and eschewing unprofitable dangers. We ought to treat it as we treat a delicate plant : we place it in the best soil available but we do not attempt to feed it forcibly. The mission of parents and educators in this case is less one of guidance than of protection. They must stand by but interfere as little as possible. They must try to be like guardian angels of a more tangible kind.

But again, how shall they know whether the child committed to their care is a child of genius or simply a precocious imp? They can never know with any certainty, but as their duty is

at any rate more passive than active, if they fulfil it they can do no harm. Without fixing any rule, one could say that the very brilliant child is more likely to be of the precocious type; in other words, he is probably not quite as good as he seems. Many of the children who are so brilliant at ten, turn out to be very ordinary at twenty and mediocre at thirty. On the other hand, the genuine child of genius who is already feeling his way unconsciously towards a definite and distant goal, is likely to be often absent-minded and dreamy, to neglect some of his lessons, to have fits of melancholy and despair, to be at some times too sensitive and at others irresponsive and even so detached as to discourage sympathy. If such peculiarities are connected with unusual intelligence, parents and teachers ought to beware and to be as kind and sympathetic as they can possibly be, without being tyrannical. This does not mean that they ought to be lax, not by any means. They must avoid the heaping up of many duties on a little body which may be already tormented inside by unknown forces and disproportionate aspirations, but whatever duties they impose ought to be strictly enforced. Character is an essential part of genius, it is the backbone of it. One's genius cannot be fulfilled without a great capacity for labor and sacrifice and this implies self-discipline of the highest order. Character is thus supremely important; it is the measure of the fullness of life. Thus one ought to do whatever is possible to strenghten the child's character by a wise combination of stern discipline and invigorating freedom. He must be expected to do his duty as far as he is able, but not farther, or he might be crushed. Above all, parents ought to avoid praising him too much. A moderate amount of praise is necessary, but any excess is corrupting. As soon as the child is old enough he ought to be given to read the life stories of men of genius, honest biographies emphasizing the struggles, internal and external, rather than the triumphs. They ought to instill into him a reasonable amount of self-confidence tempered with humility. It would be well to help him bear in mind that the greatest men generally did not realize their own greatness, or if they did, did not try to make other people acknowledge it, except tacitly by their own works. Those who claim to be great, are likely to be small. True greatness expects no privilege except that of service.

This essay contains a double message to parents and teachers and in general to all those to whom the infinitely precious souls of children are entrusted. Let them beware of brilliancy and resist their tendency to be too easily pleased with it. Parents of brilliant children ought not to be too proud; there is perhaps nothing in that to be proud of. Parents of rather dull and unattractive children ought not to be unduly discouraged; these "ugly ducklings" are perhaps the great men and women of to-morrow. On the other hand, the brilliant are more likely to be fortunate in a worldly sense, to obtain wealth, popularity and what folks conceive as happiness; thus their mothers may have good reason to be happy. The mother of the "ugly ducklings" ought to realize that if her child is really great, his fate is more likely to be hard, one of uninterrupted labor and devotion. Thus her pride is naturally tempered with sadness and so purified. To be the mother of a child of genius is not in any sense a worldly triumph, but a glorious sacrifice.

GEORGE SARTON.

The Treatise on the Egyptian Pyramids

(Tuḥfat al-kirām fī khabar al-ahrām)

by JALĀL AL-DĪN AL-SUYŪṬĪ

Edited,

with introduction, translation, and notes (*).

The work here presented is one of an enormous number of minor compilations on an infinite variety of subjects, made by the famous Arab polyhistorian ABŪ AL-FAḌL 'ABD AL-RAḤMĀN IBN ABĪ BAKR IBN MUḤAMMAD IBN ABĪ BAKR, known as JALĀL AL-DĪN AL-SUYŪṬĪ, or for short JALĀL AL-SUYŪṬĪ, who lived from 849/1445 to 911/1505. For a short biography of him and a list of his works see BROCKELMANN's *Geschichte der arabischen Literatur*, II, pp. 143-158; Supplement, II, pp. 178-198. The present work is found on p. 157, and p. 196 of Suppt., under the number 283.

Although BROCKELMANN, in common with other bibliographical sources, lists it as an independent work and the text itself gives no indication to the contrary, the treatise is really an enlarged redaction of the corresponding chapter in one of AL-SUYŪṬĪ's major works, his history of Egypt entitled *Kitāb Ḥusn al-muḥāḍara fī akhbār Miṣr wal-Qāhira*. Like most Arabic works on matters of antiquity, the treatise is predominantly composed of extracts

(*) For Arabic text order Document 1064 from American Documentation Institute, care of Science Service, 2101 Constitution Ave., Washington, D. C., remitting 40 cents for microfilm form; $ 2.00 for photocopies readable without optical aid.

Extended versions or material supplementary to articles in this journal, when so indicated by footnotes, are available as American Documentation Institute Documents in the form of microfilms (images 1 inch high on standard 35 mm. motion picture film) or photoprints (6 × 8 inches in size, readable without optical aid.) For detailed information write American Documentation Institute, care of Science Service, 2101 Constitution Ave., Washington, D.C.

from older writers, many of whom, in their turn, depended more or less upon still older authorities, without being too anxious to indicate the source of their information. AL-SUYŪṬĪ, too, does not always name his authorities, and in one passage, at least, he is directly copying word for word from AL-DIMISHQĪ without saying a word about it. Such cases of direct plagiarism are fairly frequent in Arabic literature, and AL-SUYŪṬĪ himself was often accused of it, with good reason.

The prose authorities whom AL-SUYŪṬĪ indicates specifically by name are as follows (titles of works are given within parentheses):

'ABD AL-RAḤMĀN IBN 'ABD ALLĀH IBN 'ABD AL-ḤAKAM, died 257/871. (*Futūḥ Miṣr*). BROCKELMANN, I, 148.

MUḤAMMAD IBN 'ABD ALLĀH IBN 'ABD AL-ḤAKAM, the brother of the preceding, died 262/875. BROCKELMANN, II, 692.

ABŪ ZAYD AL-BALKHĪ, died 322/934. BROCKELMANN, I, 229.

ABŪ AL-ḤASAN 'ALĪ IBN AL-ḤUSAYN AL-MAS'ŪDĪ, died 345 or 346/956 or 957. (*Akhbār al-zamān wa-man abādahu 'l-ḥidthān*). BROCKELMANN, I, 144f.

MAḤMŪD IBN 'UMAR AL-ZAMAKHSHARĪ, died 538/1143. (*Kitāb al-amkina*). BROCKELMANN, I, 289ff.

'ABD AL-RAḤĪM IBN 'ALĪ AL-'ASQALĀNĪ, called AL-QĀḌĪ AL-FĀḍIL, died 596/1199. BROCKELMANN, I, 316.

IBRĀHĪM IBN WĀṢIF SHĀH AL-MIṢRĪ AL-KĀTIB, 7th/13th century. BROCKELMANN, I, 335f.

ḌIYĀ' AL-DĪN MUḤAMMAD IBN 'ABD AL-KARĪM IBN AL-ATHĪR, died 637-1239. (*Risālat al-azhār?*). BROCKELMANN, I, 297.

SHAMS AL-DĪN ABŪ AL-MUẒAFFAR YŪSUF SIBṬ IBN AL-JAWZĪ, died 654/-1257. (*Mir'āt al-zamān*). BROCKELMANN, I, 347.

'ALĪ IBN MŪSĀ IBN SA'ĪD AL-MAGHRIBĪ, died 673/1274 or 685/1286. (*Al-Mughrib fi ḥulā 'l-maghrib*). BROCKELMANN, I, 336f.

MUḤAMMAD IBN IBRĀHĪM AL-KUTUBĪ, called AL-WAṬWĀṬ, died 718/1318. (*Mabāhij al-fikar*). BROCKELMANN, II, 55.

TĀJ AL-DĪN MUḤAMMAD IBN 'ABD AL-WAHHĀB IBN AL-MUTAWWAJ AL-ZUBAYRĪ, died 730/1330. (*'Ajā'ib Miṣr*, presumably identical with, or an extract from his *Iqāẓ al-mutaghaffil wa-'tti'āẓ al-mutawassil*). ḤĀJJĪ KHALĪFA, I, 516; II, 146; III, 161.

AḤMAD IBN YAḤYĀ IBN FAḍL ALLĀH, died 749/1348. (*Masālik al-abṣār fī mamālik al-amṣār*). BROCKELMANN, II, 141.

IBN AL-MUNĀWĪ (perhaps identical with the Egyptian QĀḌĪ YAḤYĀ IBN SA'D AL-DĪN AL-MUNĀWĪ, died 871/1466. BROCKELMANN, II, 77).

Two prose authors are quoted anonymously, viz. :

ʿAbd al-Laṭīf ibn Yūsuf al-Baghdādī, died 629/1231. (*Mukhtaṣar ʿajāʾib Miṣr*). Brockelmann, I, 481.

Shams al-Dīn Muḥammad al-Dimishqī, died 727/1327. (*Nukhbat al-dahr*). Brockelmann, II, 130.

To these might be added two traditionists, mentioned in the text, viz. :

ʿAbd Allāh ibn Shubruma al-Khuzāʿī, died 144/761. Ibn Ḥajar, *Tahdhīb al-Tahdhīb*, Hyderabad, 1325-27/1907-09, V, 250f.

Saʿīd ibn ʿUfayr, died 226/841. Al-Kindī, *The governors and judges of Egypt*, éd. Guest, p. 25f.

The poets quoted in the text are as follows :

Aḥmad al-Mutanabbī, died 354/965. Brockelmann, I, 86ff.

ʿAbd al-Wahhāb ibn al-Ḥasan ibn Jaʿfar ibn al-Ḥājib, died 387/997. Al-Maqrīzī, *Das Pyramidenkapitel*, ed. Graefe, p. 44.

Abū al-Ṣalt Umayya ibn ʿAbd al-ʿAzīz al-Andalusī, died 529/1134. Brockelmann, I, 486f.

Ẓāfir al-Ḥaddād, died 529/1135. Brockelmann, I, 260.

ʿUmāra al-Yamanī, died 569/1175. Brockelmann, I, 333f.

ʿAlī ibn Muḥammad ibn al-Sāʿātī, died 604/1207. Brockelmann, I, 256.

Aḥmad ibn Muḥammad, called al-Shihāb al-Manṣūrī, died 887-1482. Al-Suyūṭī, *Naẓm al-ʿiqyān*, ed. Hitti, p. 77ff.

Sayf al-Dīn ibn Jubāra.

The text presented here is based on Cod. Landberg 359 of the Yale University Library, a modern (19th century) copy of 6 leaves, in fair naskhī, which was collated by the copyist with two other and undoubtedly much older mss. Variant readings were also obtained from the following mss. :

Berlin Staatliche Bibliothek. An incomplete copy (Ahlwardt 6112). Through the courtesy of Bibliotheksrat Dr. Weisweiler.

Gotha Herzogliche Bibliothek (Pertsch 1688). Through the courtesy of the director Dr. Paul Richter and Dr. Weisweiler.

Cambridge University Library. An incomplete copy (Browne 227). Through the courtesy of the curator Mr. Goodman and Professor Storey.

The text of al-Suyūṭī's *Ḥusn al-muḥāḍara* was also compared, in the lithographed edition (Bulaq, about 1860), and the printed edition of Cairo, 1299/1882; both, however, present a very unsatisfactory text.

ABBREVIATIONS

B	The Berlin ms.
C	The Cambridge ms.
G	The Gotha ms.
Y	The Yale ms.
H	AL-SUYŪṬĪ's *Kitāb Ḥusn al-muḥāḍara.*
Hl	The lithographed edition of the *Ḥusn*, Bulaq, about 1860.
Hp	The printed edition of the *Ḥusn*, Cairo, 1299/1882.
M	AL-MAQRĪZĪ. *Das Pyramidenkapitel in al-Makrizi's "Hitat"... herausgegeben und uebersetzt von Erich Graefe. Leipzig*, 1911. (*Leipziger semitistische Studien*, V, 5).
ITB	IBN TAGHRĪ BARDĪ. *Abu 'l-Mahasin 'Ibn Tagri Bardii Annales... Ediderunt T. G. J. Juynboll et B. F. Matthes. Lugduni Batavorum*, 1852-61.
Yaq.	YĀQŪT. *Jacut's Geographisches Wörterbuch... herausgegeben von F. Wuestenfeld. Leipzig*, 1866-71.
D	AL-DIMISHQĪ. *Cosmographie de Chems-ed-Din Abou Abdallah Mohammed ed-Dimichqui... publiée par A. F. Mehren. Saint-Pétersbourg*, 1866.
AL	'ABD AL-LAṬĪF. *Abdollatiphi Compendium memorabilium Aegypti... edidit J. White. Tubingae*, 1789.
IFA	IBN FAḌL ALLĀH's *Masālik al-abṣār*, ed. by AḤMAD ZAKĪ Pāshā. Vol. I, Cairo, 1924.
IAH	IBN 'ABD AL-ḤAKAM. *The history of the conquest of Egypt... known as the Futūḥ Miṣr of Ibn 'Abd al-Ḥakam. Edited... by Charles C. Torrey. New Haven*, 1922. (*Yale oriental series. Researches, III*).

THE DELIGHT OF THE NOBLE CONCERNING THE PYRAMIDS

composed by the accomplished scholar, the shaykh Jalāl al-Dīn al-Suyūṭī—of whose blessings may God give us the benefit in both this world and the next. Praise be to God the lord of both worlds!

In the name of God, the merciful lord of compassion. May he bless our lord Muḥammad and his kin and companions and give them salvation. Praise be to God and peace upon His

servants whom He has chosen. I have entitled this essay " The delight of the noble concerning the Pyramids."

IBN 'ABD AL-ḤAKAM says in his " Conquest of Egypt " : According to some traditionists, the Pyramids were built at the time of SHADDĀD IBN 'ĀD. However, I have found no informed person among the Egyptians who had any authentic information on the Pyramids, and that is what the poet alludes to when he says :

The Pyramids baffle the minds of men of intelligence,
And (the most extravagant) dreams become insignificant compared with their magnitude.
Smooth, of triangular build, and lofty,
Arrows shot to their utmost distance fall short of them. (1)
I know not—since meditation stops short before them,
And conjecture is perplexed by their marvel—
Whether they are graves of heathen kings,
Talismans against the (ravages of the) sand, or monuments.

He (2) says : I think the Pyramids must have been built before the Deluge, for had they been built after it, men would have known something (definite) about them.

Several historians (3) say that the builder of the Pyramids was SAWRĪD, the son of SALYŪF, king of Egypt, who lived three hundred years before the Deluge. The cause of it was as follows : He dreamed that the earth had turned upside down over its inhabitants, men were thrown down on their faces, and the stars collapsed, crashing one against the other with terrific noise. This dream worried him, but he kept it to himself. Thereupon he dreamed again that the fixed stars had come down to earth in the shape of white birds, and kept seizing human beings and throwing them between two mighty mountains, which then slammed shut over them; all the while the luminous stars remained obscured. Awakening in terror, he assembled the chiefs

(1) 'ABD AL-LAṬĪF (p. 53) says : In my presence a bowman, who was with us, shot an arrow along the height of one of the Pyramids as well as along its width, and the arrow dropped at less than half of the distance (in both cases).

(2) Or rather, according to AL-MAQRĪZĪ, his brother MUḤAMMAD IBN 'ABD AL-ḤAKAM.

(3) According to AL-MAQRĪZĪ, this account is by IBRĀHĪM IBN WĀṢIF SHĀH AL-KĀTIB.

of the priests from all the provinces of Egypt, to the number of one hundred and thirty priests, headed by their dean POLEMON (4) (IBLIMŪN). After he had narrated (his dreams) to them, they measured the elevation of the stars, and having done this fully and thoroughly, they deduced the fact of the impending Deluge. The king asked, "Will it reach our country also?" "Yes," said they, "and it will be devastated, and remain so for a number of years." Whereupon the king ordered the building of the Pyramids.

He had canals constructed within them, bringing the (water of the) Nile to a certain point and leading it on to points in the West and in Upper Egypt. He filled the Pyramids with talismans, wonderful things, riches, treasures, etc., and inscribed upon them the sayings of the wise men, including all the secret sciences, the names of drugs and their benevolent and injurious properties, the science of talismans, arithmetic, geometry, and medicine, all this explained (so as to be clear) to him who knew their writing and their languages.

When the king issued the order for the construction of the Pyramids, they hewed out giant columns and awe-inspiring stone-plates, and brought over blocks of rock from the region of Aswān, wherewith they built the foundations of the three Pyramids, binding them together with lead (solder) and iron (pins). They built the gates of the Pyramids forty cubits below the ground, and made the height of each Pyramid one hundred royal cubits, which is equal to five hundred of our cubits, such as we use today; each of their sides was made also one hundred royal cubits long. The building of the Pyramids was begun under a favorable star, and when they were completed the king had them covered with colored brocade from top to bottom, and instituted a festival in their honor which was attended by all the people of his realm.

In the Western Pyramid he made thirty treasure chambers, and filled them with abundant wealth, (various) instruments, and images made of exquisite jewels, as well as fine iron tools, rustproof weapons, glass (of such excellent quality) that (it) would bend and yet not break, strange talismans, (various) kinds of simple and compound drugs, deadly poisons, and other things.

(4) Or PHILEMON?

In the Eastern Pyramid he constructed models of the celestial spheres and stars, and (placed there also) the finely wrought images made by his ancestors, as well as the incenses which were offered before them, and the (sacred) books relating to them. In the great colored Pyramid he placed the bodies of the (deceased) priests, (laid out) in coffins of black quartz. With (the body of) each priest was placed his book, recording the miracles which he had wrought and (containing) a general account of his life, the contemporary events, and the past and future happenings, from the beginning of time until its end.

For each Pyramid he made a guardian, the one for the Western Pyramid being an idol of quartz, standing upright and holding a sort of a javelin; around his head was coiled a snake, and if anyone approached the idol, the snake would leap at him, no matter from which direction the man came, and would coil itself around his neck, kill him, and then return to its place.

The guardian of the Eastern Pyramid was an idol of black onyx with brilliant (widely) open eyes, sitting upon a throne and holding a sort of a javelin. If anyone (so much as) looked at him, he would hear such a roar from the direction of the idol, that the man's heart would be seized with terror and he would sink upon his face and be unable to flee, even until he died.

For guardian of the colored Pyramid he made an idol of baht (5) stone, (sitting) upon a pedestal of the same material. If anyone looked at him, the idol would seize him and hug him tightly, and would not release him until he died.

The Copts say in their books that the inscription engraved upon the Pyramids reads thus in Arabic translation: " I, Sawrīd the king, have built the Pyramids at such and such a time, and have completed their construction in six years. Whosoever shall come after me and shall (presume to) claim that he is like unto me, let him (try to) demolish them in six hundred years, notwithstanding that it is well known that it is (much) easier to demolish than to build. After completing the Pyramids I have covered them with (costly) brocade—let him (try to) cover them with (cheap) mats."

(5) The baht stone is a kind of stone said to be found in the Atlantic Ocean, and much prized in Western Africa; cf. Dozy, s. v.

When (6) the caliph AL-MA'MŪN (7) entered Egypt and saw the Pyramids, he was seized with the desire to know what was in them, and determined to open them. They said to him, "It is beyond thy power to do that," but he replied, "You must at least open one of them." They thereupon made for him the breach which is still open today. (To do that) they kindled fire, applied acids (8), employed blacksmiths to temper the iron (tools) and sharpen them, and (used) catapults to hurl missiles (against the side of the Pyramid). After a great deal of money was expended upon this (undertaking), the Pyramid was opened, and they found its wall to be twenty cubits thick. When they reached the end of the wall they found behind the breach a green chrysolithe jar (9) containing a thousand (giant) dinars, each dinar weighing an ounce, according to the ounce weight that we use now. They were puzzled at this (find) and could not grasp its meaning, until AL-MA'MŪN said, "Let me have an account of what you have spent to open it." They did so, and behold, it was equal to the amount that they had found, neither more nor less. They also found inside the Pyramid a square well with a square bottom, from which four doors opened into as many chambers containing shrouded corpses. At the top of the Pyramid they found a chamber with a stone sarcophagus (10) containing an idol of malachite, of human shape, inside which was a man ('s corpse) clad in a golden cuirass inlaid with jewels; on his breast lay a priceless sword, and near his head was a precious stone (11) (as large) as an egg and as brilliant as daylight. Upon it (12) was (engraved) an inscription, but no one able to read it could be found.

For years after AL-MA'MŪN had opened the Pyramid, people

(6) According to AL-MAQRĪZĪ, 8, 14, this account is from AL-MAS'ŪDĪ's *Kitāb akhbār al-zamān* (Universal Chronicle).

(7) AL-MA'MŪN, son of the famous HARŪN AL-RASHĪD, 170/786-218/833. He came down to Egypt to suppress a rebellion early in 217/832.

(8) Literally, vinegar.

(9) Literally, a miṭhara, or vessel used for ritual ablutions.

(10) Literally, basin, or tank.

(11) The word originally meant a hyacinth, but came to be used for many other stones, such as rubies, sapphires, etc.

(12) It is not certain what the "it" refers to—it may be either the jewel or the idol.

kept entering it and going inside it through the shaft which is in it; some came back safely, others met their death (therein).

Says the author of the " Mirror of Time " : One of the wonders of Egypt are the two (great) Pyramids. The width (at the base) of each one of them is five hundred cubits, and the height is just as many cubits; and as the building kept going up their tops became smaller and smaller until (finally) they reached the size of a matting carpet. They are built of marble and bear inscriptions in all the seven (known) scripts, to wit, the Greek, the Hebrew, the Syriac, the Hindu, the Himyarite, the Latin (13), and the Persian. My grandfather told me that IBN AL-MUNĀWĪ said : They calculated several times the total land tax (revenue) of the (whole) world, and (found that) it would not be sufficient to (cover the cost of) their demolition. But this, says the author of the " Mirror of Time," is nonsense, for SALĀḤ AL-DĪN (14) ordered (his architects) to take stones from the Pyramids for the building of a dam, a water-reservoir, and a bridge, and they demolished a considerable number of them. One of those who had entered the opened Pyramid, continues the aforementioned author (15), told me that he found in it a tomb (16), branching out into passageways, which often would lead one, by way of canals, (clear) to al-Fayyūm. On the face of it, says this author, it would appear that they are tombs of ancient kings, bearing their names and the secret lore of planets and magic, and other things, but people differ as to him who had built them : some say it was JOSEPH (the Patriarch), some say it was NIMROD, some say it was the queen DALŪKA (17); others, however, say that the Copts had built them before the Deluge, for they knew that it was coming, and transferred their treasures into them; nevertheless, it availed them nothing.

Some of the Egyptian shaykhs say that someone who knew

(13) The word usually means Byzantine, but since the Greek (Ionic) has already been mentioned, it must mean here the Roman, or Latin script.

(14) The gallant ruler of Syria and Egypt, known in the West as Saladin, 532/1138-589/1193.

(15) Rather, according to AL-MAQRĪZĪ, 19,4, ABU ZAYD AL-BALKHĪ.

(16) Variant : a well.

(17) This queen is said to have been the successor of the Pharao who was drowned in the Red Sea while pursuing the Israelites. Cf. on her, IBN ʿABD AL-ḤAKAM, p. 26f.

the Greek language deciphered one of the scripts engraved upon the Pyramids and found that the inscription read thus (in translation) : " These two Pyramids were built when the Swooping Vulture (18) stood at the sign of the Cancer." This was thirty six thousand years before our Prophet (MUḤAMMAD) (according to some), while others make it seventy six thousand years. It is said that the script engraved upon them dates four thousand years before the building of Cairo, and is no longer known to any man.

When AḤMAD IBN ṬŪLŪN (19) became ruler of Egypt, he conducted excavations at the gates of the Pyramids. In (one of) these diggings they found a fragment of coral inscribed with lines of Greek. Someone who knew this (writing) was brought in, and it was found to consist of verses; they were translated and read, in part, thus :

I am he who built the Pyramids all over Egypt,
Their former owner and overseer.
I left in them vestiges of my knowledge and wisdom,
Which, in spite of (the passage of) time, will neither decay nor become blunt.
In them are abundant treasures and wonderful things,
(Which shall endure) even though time sometimes is tender (to things) and sometimes destructive.
In them are all the branches of my learning, although
I know beforehand that I shall die, and that they shall (ultimately) become known (to all).
My secrets shall be opened, and my wonders shall be revealed,
And in the end of time they shall illumine the night.
Eight, and nine, and two, and four,
And seventy after two hundred shall be completed (20);
After this I count (21) ninety (more) periods of time,—
Then the temples shall fall into the river and be destroyed.
Reflect thou upon my deeds, engraved by me in stone,—
They shall remain; I shall perish before them, then they, too, shall disappear.

(18) The bright star in the constellation of Lyra.

(19) AḤMAD IBN ṬŪLŪN, sultan of Egypt, and founder of the Tulunide dynasty, 220/835-270/884.

(20) The meaning of this cryptic oracle is presumably that 8,924,270 years shall elapse.

(21) Literally, pass.

IBN ṬŪLŪN thereupon gathered his wise men and asked them to calculate this time, but they were unable to do it accurately; they therefore gave up all hope of opening the Pyramids.

The author of the " Joyful Thoughts " says : The Pyramids situated in the provinces of Egypt are the kind of buildings which do not perish, while time (itself) perishes, and while the guide-posts of time disappear, the fame of the Pyramids does not. There are many of them, but the largest of them are the two at Gizeh, near Cairo. It is said that they were built by SAWRĪD, son of SALHŪF and grandson of SHIRYĀQ, before the Deluge, as a result of a dream which he had had. He told it to the priests, who examined the indications of the luminous stars concerning events about to happen in the world, and having determined their stations at the time of the inquiry, they found that the stars were about to descend from the heavens and surround the face of the earth. The king thereupon gave orders for the building of the temples and the great Pyramids. He engraved upon them the images of the stars, their (positions in) degrees, their actions, secrets, natural properties and laws, and the art of star-gazing. Others (22) say that it was HERMES, he of the triple wisdom (23), called by the JEWS ENOCH (24), and the same person as the blessed IDRĪS (25), who deduced from the position of the stars that the Deluge was about to come, and gave orders for the building of the Pyramids and the deposition in them of treasures, books on the sciences, and other valuables which, one might fear, would perish and disappear. Each of the Pyramids has a square foundation and is of gradually tapering shape. Its height vertically is three hundred and seventeen cubits. It is enclosed by four surfaces forming equilateral triangles, each side being four hundred and sixty cubits long. It goes up (into the air) until it (reaches its summit which) is six cubits by six. It is said that on its summit there was (loosely) placed a (round)

(22) Rather, AL-DIMISHQĪ.

(23) i.e., HERMES TRISMEGISTUS.

(24) The identification of ENOCH with the Thrice-Great HERMES was first made apparently by the Syriac writer BARHEBRAEUS, who seems to have confused HERMES, unwittingly or deliberately, with the Persian HORMUZ.

(25) The Prophet IDRĪS appears already in the Koran (XIX, 57; XXI, 85), but his identification with ENOCH is the work of post-Koranic writers. Cf. WENSINCK's article s.v. in the *Enc. of Islam*.

stone shaped like a ball of thread, and although fierce winds continously pounded at it, yet it was arranged with such superb skill of workmanship, such perfect symmetry, and such fine care, that down to the present time it has never moved, in spite of the fierceness of the winds, the downpours from the clouds, and the shocks of earthquakes. They are so constructed that the layers of cement between the stones (are so excellent in quality that they) look like white cloaks spread (flat) between stones, or (white) sheets (of paper); (the stones are so firmly joined together that) there is not enough of a gap between them to hold a hair (26). Each of their stones is five cubits by two, and it is said that the builder had made for each of the two Pyramids several doors, built over underground vaults made of stone; the length of each vault is twenty cubits, and each door is made of a single stone revolving upon a hinge in such a way that when the door is shut one would not notice that it was there. Each door leads to seven chambers, and each chamber bears the name of a star and is locked with locks. Before each chamber stands a concave idol of gold with one of his hands upon his mouth and with a Himyaritic inscription upon his forehead. When the inscription is read (aloud) his mouth opens and in it is found a key wherewith the lock may be opened.

The Copts say that both the great Pyramids and the colored one are tombs, the Eastern one being the tomb of king SAWRĪD, the Western one that of his brother HARJĪB, and the colored one that of IFRABIYŪN son of HARJĪB. The Sabians, however, say that one of the great Pyramids is the tomb of SETH, the other one the tomb of HERMES, and the colored one the tomb of ṢĀB, son of HERMES, after whom the Sabians are named. They make pilgrimages to the latter Pyramid, sacrifice cocks and black calves, and burn incense before it.

When AL-MA'MŪN opened the Pyramid, he struck a narrow shaft, made of black quartz (so hard) that iron (tools) could not work it, between two railings running along the wall. Hollows were chiseled out in the (railings of the) shaft, so that the visitor might take hold of these hollows and enable himself to walk down the shaft without sliding. In the lower part of the shaft

(26) The text is here corrupt; cf. the note to the Arabic text.

is a large and deep well, and they say that at the bottom of the well are doors leading to many places, (such as) chambers, closets, and other wonderful places. At the end of the shaft AL-MA'MŪN's men found a square place in the center of which was a covered basin of granite; whenever they lifted up its lid they found nothing but worn out pieces of rope.

IBN FAḌL ALLĀH says in his "Paths": People tell many (different) stories about the cause of the building of the Pyramids. Some say they are temples (for the worship) of the stars, some say they are tombs and storehouses for wealth and books, others say they are shelters against the Deluge, which latter is the most improbable of all, for they do not look like living quarters. The Sabians, continues IBN FAḌL ALLĀH, used to make a full pilgrimage to one of the (two) Pyramids, and (merely) visited the other, which latter they thought to be of far lesser sanctity than the former. As for the "Father of Terror," (27) it is an idol situated in a slight depression near the greater Pyramid. Nothing is seen above the surface of the earth but this idol's head and neck. It bears a Negroid head of terrifying aspect, and its face is covered with red paint, which has not come off in spite of its great age. It is said that it is a talisman which protects the cultivated area against the sand (of the desert). JOSEPH (the Patriarch's) gaol is situated on the left of the Pyramids, some distance from the Sphinx, at the extremity of a mountain pass, at the end of the barrier.

Says the author of the "Joyful Thoughts": In Dahshūr, one of the districts of Gizeh, is a Pyramid built by SHADDĀD, son of 'ĀD, son of ZAWRASHĪR, son of NAQṬUR, son of MIṢR, the founder of Egypt. Some say, on the authority of 'ABD ALLĀH IBN SHUBRUMA, that when the Amalekites came to Egypt after having been expelled from Mecca by the Jurhumites, they settled there, built the Pyramids, and supplied them with various artifices and wonders; they remained in Egypt until their expulsion by MĀLIK IBN DU'R AL-KHUZĀ'Ī (28).

SA'ĪD IBN 'UFAYR says: The shaykhs of Egypt keep on saying that the Pyramids were built by SHADDĀD, the son of 'ĀD.

(27) The Arab name for the Sphinx.

(28) Cf. *Enc. of Islam*, s.v. 'Amālik and Djurhum, and the sources listes there.

The Egyptians used to believe in the resurrection of the dead, and whenever anyone of them died, his entire wealth was buried with him; if he was a craftsman, his tools (also) were buried with him.

MUḤAMMAD IBN 'ABD ALLĀH IBN 'ABD AL-ḤAKAM says : From the back of the Pyramids to the West there were four hundred towns, not counting the towns from Cairo westwards, to the West of the Pyramids.

IBN AL-MUTAWWAJ, in his book on the " Wonders of Egypt, " says : On the Western shore of Egypt are the structures known as Pyramids, eighteen in all, of which three are in Gizeh, opposite al-Fusṭāṭ. When AL-MA'MŪN opened one of them he came upon a sarcophagus covered with a marble tablet and filled with gold. The tablet was covered with lines of writing. They searched for someone who could read it, and (having found him were told that) it read thus : " We built this Pyramid in one thousand days; we shall attach no blame to him who shall demolish it in one thousand years (if he can), notwithstanding that demolishing is (much) easier than building. In each quarter of it we have placed such an amount of wealth as would have to be spent in order to reach it, neither more nor less." Near Madīnat Fir'awn Yūsuf (29) there is another Pyramid, three thousand cubits in perimeter and seven hundred cubits high. Near Madīnat Fir'awn Mūsā (30) there are several Pyramids, one of them known as the Pyramid of Maydūm; it is as large as a mountain and consists of five stories, the upper one having the appearance of a fort on top of a mountain.

AL-ZAMAKHSHARĪ says : The two Pyramids of Gizeh are situated two parasangs off al-Fusṭāṭ. Each one of them is four hundred cubits wide, and its foundation is more than a jarīb (31). They are built of marble slabs, brought over from a place called Dhat al-Ḥammām, forty parasangs away, beyond Alexandria. They rise so high in the air that their (top has an) area of only five spans by five, and there is no structure on the face of the earth higher than they are. There are engraved upon them, in Himyaritic characters, all sorts of charms, talismans, and

(29) " The city of the Pharao of Joseph."
(30) " The city of the Pharao of Moses."
(31) A measure of land.

remedies, as well as the following inscription: "I have built them; whoever shall claim that this kingdom is like mine (in greatness), let him demolish them (if he can)." (The fact is) however, that the land tax (revenue) of the whole earth would not be sufficient to pay for their demolition. It is said that no one knows who built them.

AL-MAS'ŪDI says: The length and width of each of the two Pyramids is four hundred cubits, and their foundation is (the square of) their height. Each contains seven chambers, according to the number of the seven planetary stars, each chamber being under the name of a star and its aegis. At the side of each chamber there was erected a concave golden idol, with one of its hands placed over its mouth, and a hieratic inscription upon its forehead. When the inscription is read (aloud), its mouth opens and a key to the (chamber's) lock comes out. These idols receive(d) their own sacrifices and frankincense, and have spirits assigned to them charged with guarding the chambers, their idols, and their contents, consisting of images, (books on the) sciences, wondrous things, jewels, and (other) treasures. In each Pyramid is (buried) a king('s body), laid in a covered stone sarcophagus, together with a scroll containing his name and his particulars, (all) guarded by talismans, so that no one might reach him until the appointed time shall have come. Some say that the Pyramids contain water courses, through which flows the Nile, and storage tanks holding much water, of corresponding size; and that one of these courses leads to the desert of al-Fayyūm, a distance of two days' journey.

In the days of AḤMAD IBN ṬŪLŪN a company of people entered the great Pyramid and found in one of its chambers a glass cup, of strange color and form. After they had left, they missed one of their number, and reentered (the Pyramid) in search of him. He came out to meet them, naked and laughing, and said: "Do not tire yourself searching for me;" thereupon he fled back into the interior of the Pyramid. They then realized that the evil spirits had taken possession of him. The news of this event spread about, until it reached IBN ṬŪLŪN, who (forthwith) issued a prohibition against entering (the Pyramid) and took the cup away from the finders. He filled it with water and weighed it; then poured the water out and weighed the cup again, and

behold, its weight both when full and when empty was the same.

It is said that the spirit in charge of the seaward Pyramid has the shape of a naked woman with her private parts uncovered (32) and with her tresses reaching down to the ground. Several people have seen her going round the Pyramid at midday. The spirit in charge of the neighboring Pyramid has the form of a naked, tawny, and beardless youth, and was seen going round the Pyramid after sunset. The spirit in charge of the third Pyramid has the shape of an old man holding a censer and clad in monkish garb; he was seen going around the Pyramid at night. All this (information) is recorded by the author of the " Mirror."

AL-QĀḌĪ AL-FĀḌIL says: The two Pyramids mark the apex of the earth. All things fear time, excepting the two Pyramids, for time fears them.

Here are some of the poems which deal with the two Pyramids at Gizeh:

AL-MUTANABBĪ says:

Where is he who had constructed, among other buildings, the Pyramids,
Who are his people, what was his (last) day, how did he die?
These monuments have outlived their inhabitants
For a while, yet destruction shall (ultimately) overtake them, too, and they will follow (their builders).

ABŪ AL-ṢALT UMAYYA IBN 'ABD AL-'AZĪZ says:

By thy life! Hast thou seen anything of more beautiful aspect
Than what thine eyes had seen of the two Pyramids of Egypt?
They rise (far) into the summit of the sky, and overlook
The ether, just as Vega (32a) overlooks the Lyra.
They reach a lofty height above the earth,
As if they were two breasts standing out over a (woman's) bosom.

(32) This seeming tautology (" naked "—" uncovered ") is explained by the fact that Moslems do not uncover entirely even in bathing, but wear a loin towel through the entire period from undressing for the bath to dressing after it.

(32a) The Arabic term, Simak, is usually translated as Arcturus, which is here astronomically impossible.

The jurist ʿUMĀRA AL-YAMANĪ, the (well-known) poet, says :

O my two friends (33) ! There is no structure under the sky
That might equal in perfection the two Pyramids of Egypt,—
(They are) structures of which time is in fear, while all
That is on the face of the earth fears time.

Says another poet (34) :

Look at the two Pyramids, how they show themselves
To the eye in their height and loftiness.
It is as if the wide earth, having
Become thirsty because of the excessive heat and the drouth (35)
Had uncovered her breasts, and laid them bare,
Calling upon God to have pity on her children.
And He has answered her with the Nile, granting her relief
With copious moisture, thereby relieving her distress.

Says ẒĀFIR AL-ḤADDĀD :

Consider the form of the two Pyramids, and look (at them)
And (at) the wondrous Father of Terror between them.
(They are) like unto two squadrons (36) on the march (with an interval separating them),
Or like two lovers with a chaperon between them.
The waters of the Nile (flowing) between them are like (lovers') tears,
And the howling of the wind around them is like (lovers') sobs.
Between them rises (the hill of) al-Muqaṭṭam, resembling
The (triangular) stirrup of a riding camel, forced to his knees by fatigue.
The (dark) façade of Joseph's gaol looks like a lover
Left behind (by his beloved), sad and overcome with grief.

Says IBN AL-SĀʿĀTĪ :

Among the wonders (of the world)—and there are many wonders
That are too great for exaggeration and magnification—

(33) The conventional addressees of the Arab poet's verse.
(34) According to AL-MAQRĪZĪ, 44, 7f., this is ʿABD AL-WAHHĀB IBN AL-ḤĀJIB.
(35) Literally, ashes.
(36) Or, two camel-litters (so AḤMAD ZAKĪ PĀSHĀ, IFA, I, 238, note 3).

Are the two Pyramids. Time decays, its days
Come to an end, and it adds to the beauty of youth (that of old age, while the Pyramids remain forever unchangeable).
By God! Behold the miracle of an eternal building,
Coveting the sky with the longest reach (on earth).
It seems to stand in a posture of humility,
In sorrow for (the passage of) the days and years,
Concealing from the hearing (of men) the sound of its discourse,
Yet indicating it ('s meaning) clearly to (men's) hearts.

Says SAYF AL-DIN IBN JUBĀRA:

By God! What a strange and wonderful (spectacle)
Is presented by the structure of the Pyramids to (men's) hearts!
They conceal from the hearing (of men) the story of their people,
But strip all veils from their (own) wonders.

Another poet says:

It is evident that the land of Egypt has a bosom,
From which rise the two breasts—meaning the two Pyramids.
What a miracle! She has given birth to many (men)
In spite of her old age, and still these breasts stand (as) upright (as a young girl's).

When the qāḍī SHIHĀB AL-DIN IBN FAḌL ALLĀH made a journey to the Pyramids, he wrote to the AMĪR AL-JĀ'Ī (37), the secretary (of state), as follows—this was in the year 719:

I owe (you) the (customary) reward for good news, for
I have become your neighbor
In the land of Egypt, and I am not dissatisfied.
You have sheltered my youth for me in your shade,
Although you have brought me to the Pyramid (38).

(Your servant) kisses the ground (in humility and joy) and praises God for easing his breast in the shade of our Master

(37) The date corresponds to A.D. 1319.
(38) Word-play on the Arabic "haram," which means both Pyramid and senility.

and making his desire come true, this desire being (centered in) Egypt, until he found in it the goal of (his) journey. And he established his domicile in it, making the gates thereof face the castle of our Master. He admits (?) that he used to be in too great terror of the sea to set out upon its waves or to travel over its high billows. But the (opportunity of) being near to the service of our Master made him forsake his fear, and he reflected upon the anxiety which overwhelmed him, saying : I am in danger of being drowned, but I fear not the water; it is like sailing a fire-ship which cannot be extinguished, even though (fire) fears running water, and which is no pleasant sight for eyes (of men), except when they perceive the breath of the wind, (which alone may save them from the flames) (39). Then he came upon lakes (40) surrounded by gardens that fill one's eye and caress it with their covering of emerald and melted silver. He concluded his day by settling in our Master's (province of) Gizeh, where men are safe from the vicissitudes of fortune. I finally reached the two Pyramids and perceived from them that these happy days are like newlyweds, and the Pyramids are like festive tents with which (the earth) has adorned herself (for their reception).

ḌIYĀ' AL-DĪN IBN AL-ATHĪR says in his epistle, while describing Egypt : I have seen in it cities which, I testify, excell (all) other cities; they consist, I found, of Cairo and the cities beyond it, i.e. (those of) the Sawād. No one could look at them without their filling his eye and breast (with admiration), and no one could (attempt to) describe them without realizing that it is beyond his power to do so. Among their wonders are monuments which cannot be encompassed by (human) eyes, much less so by words. Among them are the two Pyramids, before which time (itself) decays while they decay not. Each one of them is remarkable for the immensity of its construction and the enormity of wealth contained in it. They reach into the air higher than any bird can fly, notwithstanding the (wide) range of its flight, or than

(39) The translation is uncertain, and the text may be corrupt. If the translation is correct, the meaning is that the author had steadfastly faced the dreaded sea-journey, knowing that it would ultimately bring him to his coveted goal, just as the passengers of a burning ship patiently bear their sufferings in the knowledge that the favorable wind will ultimately bring them safely to land.

(40) Literally, pools.

any eye, no matter how farsighted, can penetrate. When a gleam (of lightning) illuminates a Pyramid's tip, it looks to the observer like a star, and when the rainbow curves over it, it seems to serve as the rainbow's arrow.

Our teacher AL-SHIHĀB AL-MANṢŪRĪ says :

When passing by the two Pyramids, say : How many lessons
Are there in them for him who understands and considers (them) !
I liken each one of them unto a traveler
Who recognizes his goal (41), but camps (a distance) before it (42);
Or unto two lovers, whose reunion is prevented by the Father of
Terror acting as a chaperon, and who (therefore) leave him behind;
Or unto two thirsty men who had prayed to a moisture laden cloud for rain,
And it poured for them sweet water in ample bounty (43).
Time (itself) perishes (before them), and in its fear of them
There is the anger of envy and the vexation of one who realizes his impotence.

Says an anonymous poet quoted by the author of the " Interpreter " :

When kings desire to make (permanent) their memory after their death,
They think of firmly founded buildings.
Do they (44) not see the two Pyramids that have been built, and yet how many are
The kings (who had built them), who(se memory) was protected against the vicissitudes of time ?
(And yet) verily a magnificently constructed building
Is in itself an indication of a mighty builder (even if his name has been forgotten).

(41) i.e., the river Nile.

(42) To prolong the pleasure at reaching his destination; an allusion to the fact that the Pyramids are a distance inland from the river bank.

(43) Allusion to the interval between the two Pyramids, which the poet compares with a ravine produced by a rushing current of rain water between two mountains.

(44) The text has the singular " does he not," which is a poetic license used for the sake of the metre.

This is the end of the epistle entitled " Delight of the noble concerning the Pyramids." God (alone) knows best the truth (about them), and to Him do we return in repentance (for our sins and omissions). This epistle is by the shaykh JALĀL AL-DĪN AL-SUYŪṬĪ,—may God in His mercy give him His blessings. Amen.

(Yale University) LEON NEMOY.

An early American Pharmacologist : Horatio C Wood (1) (1841-1920)

The history of the preorganization period in American pharmacology is yet to be written. Although this period is rather nebulous, both as regards the personages connected with it and the influences then at work, certain individuals stand out prominently as forces which brought the spirit of inquiry into therapeutics and who did much to usher in the experimental method as the prerequisite to the treatment of disease by drugs.

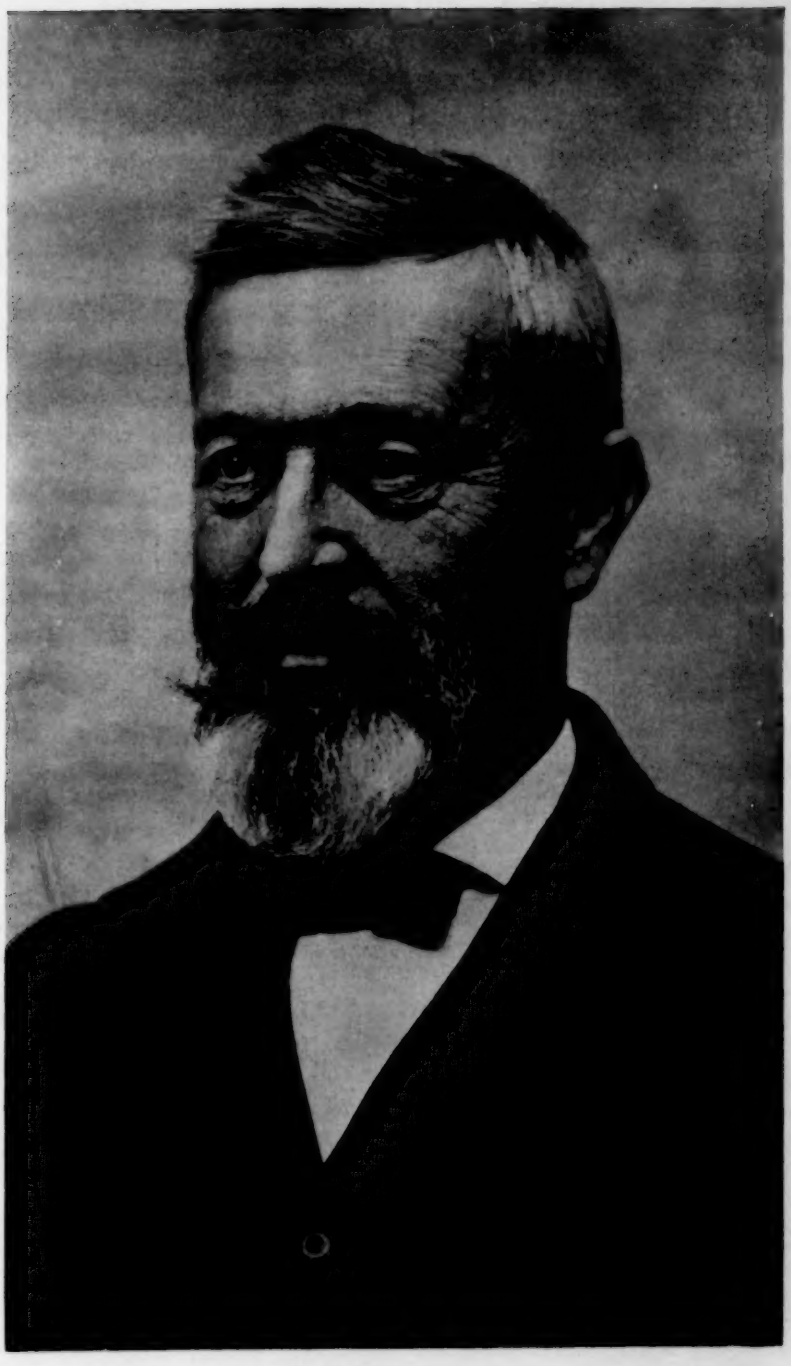
Perhaps the one who should be given the credit of being the chief among the pioneers in American pharmacology is HORATIO C WOOD, one of Philadelphia, Pennsylvania's noted Quaker sons of the later nineteenth century period, who was distinguished not only as a teaching scientist, active in the field of botany, entomology, physiology, pharmacology and pathology, but also as a therapeutist and teacher in the domain of neurology and internal medicine. As a matter of fact, he was commonly thought of as a neurologist and therapeutist and shared honors in the former field in Philadelphia with his distinguished contemporary and friend, S. WIER MITCHELL. His pupil and life-long friend, Dr. H. A. HARE, the noted therapeutist, although regarding him as a fellow therapeutist, upon the death of Dr. WOOD, distin-

(1) His name appears in the Dictionary of American Biography as HORATIO CHARLES; in the Dictionary of American Medical Biography (KELLY and BURRAGE) as HORATIO CURTIS.

His son, Dr. HORATIO CHARLES WOOD, Jr., in a personal communication under date of July 6, 1938, wrote as follows : " His middle name was not CURTIS but simply " C ".

" The story as he told it to me was that his father wanted him named HORATIO CURTIS after himself, but that his mother wanted him to be HORATIO CHARLES; so they compromised on HORATIO C."

" My father was always very insistent, often to the confusion of publishers of his writings, that no period be placed after the " C " because it was not an abbreviation but his full middle name."



Dr. Horatio C Wood
(1841-1920)

George B. Roth

UNIV. OF MICH.

guished him by naming him " the pioneer in American pharmacology," a distinction to which it seems to me he is justly entitled.

Dr. WOOD was born on January 13, 1841, in the " city of brotherly love," being a descendant in the ninth generation from the English Quakers who came over with WILLIAM PENN. Although a Quaker by birth, he was a militant force in his professional life.

His father (named HORATIO CURTIS), a successful business man in his home city, started him on his educational career at the early age of three and at four years he was sent to the Friends' boarding-school at Westtown, where " he was the smallest boy in over two hundred pupils " and where the small boy " often received a most valuable lesson in physical tenacity and endurance of punishment without flinching; qualities which in manhood, when tempered by age and judgment, are very valuable."

Later on he attended the Friends' Select School in Philadelphia, a course which he states " saved him from the herd-teaching of a university education." Here he received instruction in Latin, Greek, mathematics, and in the construction and derivation of the English language, proceeding to a point beyond most of the colleges in those subjects.

His interest in natural science began in earnest at the age of thirteen when he made the acquaintance of Professor JOSEPH LEIDY of the Philadelphia Academy of Sciences, who finding him crying over his inability to handle and study specimens in a display case in the Philadelphia Academy of Natural Sciences, arranged with the President of that society that the lad should have access to such cases as he should desire, and thus his native interest in the natural sciences was fostered.

Botany was the first of the sciences to engage his attention, his first paper published in 1860, at the age of nineteen, being contributions to the carboniferous flora of the United States, and appearing as a publication of the Philadelphia Academy of Natural Sciences. A second paper on the subject appeared in the same year and the third and last in 1866. His first paper on the fresh water algae of North America also appeared in 1867 among the publications of the Philadelphia Academy of Natural Sciences. This was followed by ten others, which included a quarto of 270 pages published by the Smithsonian Institution

of Washington in 1872. The Smithsonian publication contained nineteen colored and two uncolored plates, all reproductions of 360 microscopic drawings made by himself.

His first paper on entomology appeared in 1861 and by 1869 he had published fourteen papers in various scientific journals, all of these papers dealing with myriapoda. His work on the myriapoda came to the attention of AGASSIZ who in 1866 offered to put his recent collection of Brazilian myriapods at Dr. WOOD's disposal for study and classification.

He twice collected specimens for the Smithsonian Institution, first in the Bahamas, and later in unknown regions of the Mexican border of Texas. In the later expedition he was one of the first white men on record to see the Grand Canyon of the Rio Grande.

He entered the medical school of the University of Pennsylvania(2) from the Friends' Select School of Philadelphia, matriculating in the session of 1859-60, his preceptor being Dr. J. E. RHOADS. At that time in order to graduate, the medical school not only required attendance upon two complete courses of lectures, and a graduation thesis, but the attainment of the age of twenty-one, so that it was not until 1862 that he received his degree in medicine. The subject of his graduation thesis was " Enteric fever." The first year after graduation was spent in the Blockley Hospital as resident physician and during the next year he occupied a similar position in the Pennsylvania Hospital.

Following his residency in these two civil hospitals of Pennsylvania he joined the medical service of the United States Army, then engaged in Civil War. Returning to civil life in 1866, he immediately became affiliated with his alma mater as a private teacher or quizmaster in the Medical School. This same year, 1866, he was given the Chair of Botany in the Auxiliary Faculty of Medicine in the University, a position which he occupied for ten years. His experience as a quizmaster was the chief means by which he perfected his technique in the art of teaching. In his instruction he successfully combined the qualities of the investigator with that of the clinician. He thoroughly inspired his pupils, all of whom regarded him as a great medical teacher. It was his desire to teach them not only " to think but to try."

(2) He is listed in the catalogue of the alumni of the medical department of the University of Pennsylvania as HORATIO C WOOD, Jr.

As was the custom at that time, every teacher in a medical school was also engaged in the practice of medicine. This was true of Dr. WOOD, but it is said that he never allowed his practice (largely consultative) to interfere with his teaching duties. His early practice was devoted largely to the handling of neurological and psychiatric cases. In 1873 he was elected clinical lecturer on nervous diseases in the Medical School of the University of Pennsylvania. Two years later he was made its Professor of Nervous Diseases, a title which he held until 1902. His book, " Nervous Diseases and their Diagnosis," which appeared in 1892, was the culmination of this phase of his professional life.

In 1876 he was also made Professor of Materia Medica and Pharmacy to which title was added that of General Therapeutics, the following year. HOLMES' facetious remark that the early medical school teachers " occupied not a chair but a settee " was indeed exemplified by the appointments of Dr. WOOD. This joint professorship continued until 1906, when ill health forced his retirement from teaching, at which time he was made an Emeritus Professor.

The claim for the recognition of Dr. WOOD as the chief figure among early American Pharmacologists rests mainly upon three phases of his activities : (1) his connections with organized physiology, the parent society from which organized pharmacology developed, (2) his publications in the field of pharmacology and experimental therapeutics, (3) his influence upon the " Father of American Pharmacology"—Dr. ABEL.

The American Physiological Society, the forerunner of organized pharmacology, was formed on December 30, 1887, at which meeting Dr. WOOD was in attendance. His name will be found recorded in the list of charter members, also as being a member of the first council, which served the society in 1887-8. He attended a number of the early meetings of the society and was selected by the society to represent them at the Triennial Congress of American Physicians and Surgeons which met in Washington in 1888.

Dr. WOOD's publications numbered about three hundred, over fifty of which dealt with physiology, pharmacology and experimental therapeutics. Among these are his classics on the North American Hemp and Hyoscine.

Other papers dealt with studies on the action of atropine, veratrum, amyl nitrite, the oxytocic action of quinine, the vasomotor action of ergot, the action of alcohol on the circulation, the biological behavior and action of ethyl bromide, the volatile oils, the anesthetics, strontium and chloramide.

In this connection it should be stated that these papers were largely based upon laboratory findings obtained through the use of animals.

The papers on American Hemp *(Cannabis Sativa)* and Hyoscine, were the first pharmacological reports on these agents to appear in any literature. The introduction of these substances into therapeutics followed closely upon the publication of the original papers.

The characteristic thoroughness with which Dr. WOOD attacked a pharmacological problem is well exemplified by his examination of hyoscine. In his delightful reminiscences he states : " My attention was attracted by a rather acrimonious controversy in the European medical press concerning hyoscyamine. There was on the market an impure form of hyoscyamine, so called, a blackish liquid, and also the pure crystalline hyoscyamine. Studying the current literature, it became apparent that impure hyoscyamine was many more times potent than the pure. I wrote to MERCK, asking if he had ever chemically examined the impure hyoscyamine and had obtained anything out of it except hyoscyamine. It appeared that his chemists had isolated an alkaloid which they called hyoscine. This I studied, first thoroughly on dogs, then on myself, then on my wife, then on patients, and published the results; later I received a note from MERCK, offering to furnish me without charge any product he had and which I might want for experimentation; also he offered, if I had any chemical research in contemplation, to put all the chemists I needed at my disposal."

Many times was he compelled to appear before legislative bodies, governing councils, and members of anti-vivisection societies, to defend his experimental work with animals, and each time he silenced (for the time being) his opponents by his masterful defense of the experimental method.

His research publications, together with his keen interest in rational therapeutics, led to the publication of his monumental work in 1874 entitled, " A treatise on therapeutics, comprising

materia medica and toxicology, with especial reference to the application of the physiological action of drugs to clinical medicine."

This book was a revolt against empiricism or, as he harshly puts it, "clinical experience." It was "the outcome of his studies on animals," his aim being "to make the physiological action of remedies the principal point in discussion" and not secondary as had been the custom in preceding works on therapeutics. In his introduction to the first edition he states: "Experience is said to be the mother of wisdom. Verily she has been in medicine rather a blind leader of the blind." A further quotation from his introduction to the first edition reveals the breadth of his therapeutic horizon and indeed makes him one of the medical prophets of the 19th century. It reads as follows: "A primary knowledge of the end to be accomplished and a secondary acquaintance with the instruments are a necessity for successful human effort; and until the sway of this law is acknowledged by physicians, medicine can never rise from the position of an empirical art to the dignity of applied science. Until within a comparatively recent period, it has been impossible to comply with this law. But, through the advances made by the pathologists and by the students of the natural history of disease, we are fast learning the methods in which nature brings the body back to health."

He classified drugs according to their physiological effects, a manner of treatment which has been followed almost universally since that time. The treatise was broadly adopted by the medical schools in this country, it being so popular that it passed through fifteen editions. Furthermore, it was the principal American text book in materia medica and therapeutics for over thirty years. As has been recently expressed, "it had probably more influence than any other single book (in this country) in the originating of the idea of pharmacology as a distinct subject in the medical curriculum."

If one were to evaluate Dr. WOOD's accomplishments in pharmacology by either past or present standards, it would be found that he was justly entitled to membership in the American Society for Pharmacology and Experimental Therapeutics, the organization effected in 1909 by the American Pharmacologists through a cleavage from the American Physiological Society of which he was a charter member. At this time he had already retired from active

scientific life, due to ill health, a fact which no doubt accounts for his name not appearing on the list of charter members of the new society.

Although the capacity for research and organization was well developed in him, his laboratory did not become the mecca for the development of future pharmacologists, as did that of Dr. ABEL, "The Father of American Pharmacology." Many causes may have contributed to this, chief among them being the lack of funds for research, together with the crude nature of the "instruments of precision" which they possessed at that time. Nevertheless his laboratory was famous enough to attract Dr. ABEL to it, for in a personal communication to the writer in November, 1930, Dr. ABEL wrote: "It may interest you to know that I was a research assistant, without pay to H. C WOOD of Philadelphia in the summer months of '84 when he was working on the alkaloids of the atropine series. I did his blood pressure and respiration experiments for his research but I cannot say whether he ever published his findings or not. WOOD wanted me to stay with him to assist him in editing a journal, etc., and at the same time to continue my medical studies at the University of Pennsylvania. I had already decided to enter the Laboratory of KARL LUDWIG of Leipzig. I accordingly left this country in August of 1884."

Dr. WOOD's connection with the Pharmacopoeia of the United States covered almost three decades, two of which he served as the President of the Convention. The influence of the pharmacopoeia upon pharmacology, through the establishment of standards, especially for potent drugs, can not be readily overstated. In 1902, the Pharmacopoeia of the United States was officially represented by Dr. WOOD at the Brussels Conference called by the Belgian government to establish an International Pharmacopoeia, his knowledge of pharmacology being one of the chief reasons for his selection.

Early in his career, he was offered Professorships in the College of Physicians and Surgeons, also in the Bellevue Hospital Medical College, both of New York City; he declined both. Later in life he was invited to become the Professor of Therapeutics in the Johns Hopkins University, also the Professor of the Theory and Practice of Medicine in Jefferson Medical College, but again considered it best to remain faithful to his alma mater.

Dr. WOOD's accomplishments brought to him not only renown, but many honors. He was elected a member of the National Academy of Sciences in 1879 being listed in the section of Physiology and Pathology.

For his work on " Thermic Fever, or Sunstroke " he received the Boylston prize of the Massachusetts General Hospital and a special prize awarded by the Philosophical Society of Philadelphia.

He was President of the College of Physicians of Philadelphia in 1902 and 1903, also as previously stated, of the United States Pharmacopoeial Convention from 1890 to 1910.

His editorial experience included the editorship of New Remedies (1870-73); Philadelphia Medical Times (1873-80); Therapeutic Gazette (1884-90); United States Dispensatory (1893-1907).

His chief recreation was hunting, mainly of large game, a sport which took him to many of the remote places of the world. He hunted in Devonshire with Sir VICTOR HORSLEY on the mainland opposite the Isle of Skye, with Professor FRASER of Edinburgh and with others in many of the then little explored regions of western and northwestern America.

Dr. WOOD's philosophy of life is to be found in his reminscences which were written after many years of suffering. He succinctly states it to be : " Kindness and sympathy alike toward the highest-born and the strongest, and toward the lowest and weakest."

In his early manhood he was very active in the Methodist Church and maintained his interest in the Church until his retirement.

His religious faith he summed up in these words : " The long bitter years of suffering have taught me to wish for speedy death, with the hope and faith that the sacrifice of Christ and the mercy of the Lord would bring me to Beatitude."

He had no fear of eternal punishment or death. He could see no final fate in death other than " an escape from a life of suffering to an eternal sleep." " And so, striving during life to do the right as it is given us to see the right, may we go out with the cheery cry ' What of the night, brother, what of the night '."

His death in his eightieth year resulted from pneumonia on January 3, 1920, burial occurring in the city of his birth.

Washington, D. C. GEORGE B. ROTH.
The School of Medicine,
George Washington University.

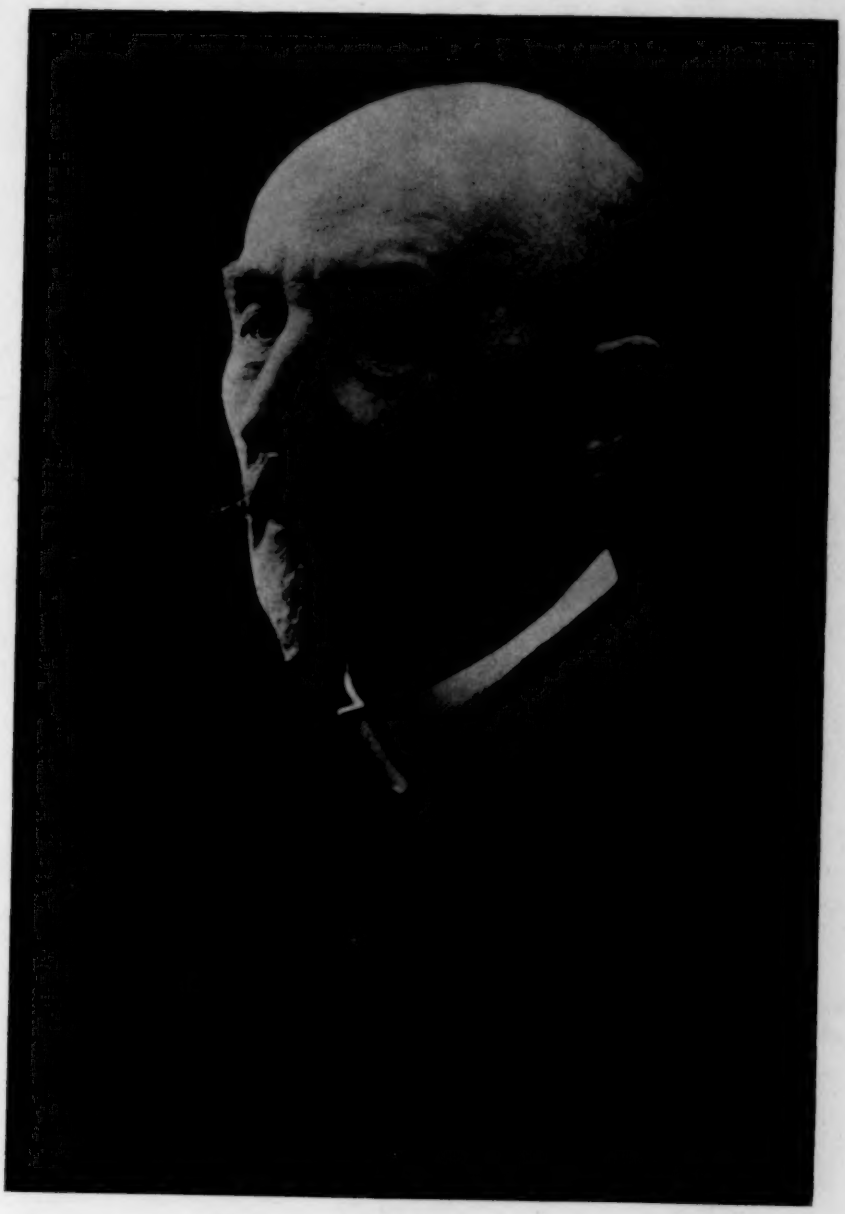
†

Paul Dorveaux (1851-1938)

Was den Menschen in höchstem Grade letztlich adelt, die hilfsbereite Güte oder wenn man lieber will, die gütige Hilfsbereitschaft gegen andere Menschen, aus *innerem* Triebe, ohne Dank-Erwartung, diese reine Güte war Paul Dorveaux in hohem Masse eigen. Das kann ich aus eigener Erfahrung, aus einer, leider nur unpersönlichen, aber um so intensiveren Correspondenz-Bekanntschaft mit dem nun Verewigten, eines sich über den Zeitraum von 1914 bis 1937 erstreckenden, also auf nicht weniger als 23 Jahre, wenn auch zeitweise unterbrochenen schriftlichen Kontaktes, vollauf bestätigen.

Zum Beweise sei hier nur auf zwei Limes, nämlich den Introïtus und den Exitus unserer Bekanntschafts-Beziehungen ein Rückblick gestattet :

Anfang 1914 : Zu einer Klar- und Richtigstellung irriger, von H. Schelenz geäusserter Ansichten über Dariot's angeblichen Gegenstromprinzip-Kühler von 1588, musste ich in Dariot's „Premier discours" (1582) und dessen „Grande chirurgie etc." (1593) selbst Einsicht nehmen können. Diese Möglichkeit hatte ich damals in Bereiche reichsdeutscher Bibliotheken nicht. Ich wusste aber, dass diese Dariot-Ausgaben in Paris, in der „École supér. de Pharmacie," vorhanden sind. Ich wandte mich daher an den damaligen Direktor der Bibliothek besagter Pharmazie-Hochschule in Paris, Herrn Paul Dorveaux, mit der Bitte, mir — der ich ihm allerdings persönlich unbekannt sei und auch sonst keine Referenzen aufgeben könne — doch vertrauensvoll jene Dariot-Ausgaben auf eine Woche zu überlassen, ich würde sie wie meinen Augapfel hüten und im status quo ante zurücksenden. Was ich nicht für möglich gehalten hätte, das wurde Ereignis : Binnen 4 Tagen erhielt ich das Gewünschte, mit einem liebens-



PAUL DORVEAUX
(1851-1938)

MAX SPETER

UNIV. OF MICH.

M

Monsieur Marcel DELÉPINE, Professeur au Collège de France, Membre de l'Institut et de l'Académie de Médecine, et Madame Marcel DELÉPINE ;

Monsieur Henri TARD, Docteur en Droit, Huissier près les Tribunaux de la Seine, Madame Henri TARD et leurs enfants Pierre, Anne-Marie et Catherine, Monsieur Victor HARLAY, Chef de Laboratoire de l'Hôpital Saint-Louis, et Madame Victor HARLAY,

Madame Paul GILLET ;

Monsieur Ferdinand GILLET ;

Monsieur Emile ESCOURROU, Directeur des Ateliers généraux du Canal de Suez, Madame Emile ESCOURROU et leur fils Pierre, Monsieur Jacques ESCOURROU, Ancien Elève de l'Ecole Polytechnique,

Monsieur Louis BERTRAND, de l'Académie Française, Mademoiselle Jane-Louis BERTRAND, Madame Emile BERTRAND et ses enfants, Madame René BERTRAND et ses enfants, le Docteur Jacques ANDT, le Docteur et Madame Pierre ANDT, Monsieur Edouard ANDT, Professeur à l'Ecole de Droit d'Hanoï, Monsieur Paul CANONNE et ses enfants, Monsieur et Madame Alexandre POLLET et leurs enfants, Madame Auguste GILLET, Monsieur et Madame Alphonse FRANÇOIS, Monsieur et Madame Edouard HAUDIDIER et leurs enfants, Monsieur et Madame Joseph HUET et leurs enfants ;

Monsieur et Madame René DORVEAUX et leurs enfants, Mesdemoiselles Hélène, Marie-Louise et Madeleine DORVEAUX et les enfants de feu Monsieur Lucien GILLET ;

Ont l'honneur de vous faire part de la perte douloureuse qu'ils viennent d'éprouver en la personne du

Docteur Paul DORVEAUX

Bibliothécaire en Chef Honoraire à la Faculté de Pharmacie de Paris

leur père, beau-père, grand-père, bisaïeul, beau-frère, oncle, grand-oncle, arrière-grand'oncle et cousin, décédé le 7 Janvier 1938, en son domicile, à Paris, avenue d'Orléans, N° 58, à l'âge de 86 ans, muni des Sacrements de l'Eglise.

PRIEZ POUR LUI !

Selon le désir du Défunt, la cérémonie religieuse a été célébrée dans l'intimité en l'Eglise Saint-Pierre de Montrouge, suivie de l'inhumation au cimetière de Montrouge (Seine)

10 bis, boulevard de Port-Royal, Paris V^e^
48, avenue de Saxe, Paris VII^e^.
132, boulevard du Montparnasse, Paris XIV^e^.

Administration spéciale des Funérailles, 182, avenue du Maine, Paris XIV^e^ Maison Henri de BORNIOL - Téléph. Ségur 13 ?.

würdigen Schreiben ! (1) Für meine Beweisführungen waren nun einige Holzschnitt-Reproduktionen aus jenen DARIOT-Texten erforderlich, die ich, da es Anno 1914 noch keine Photokopier-Möglichkeit gab, mir mühselig-geduldig auf „Pergament"-Papier durchzeichnete. Aber wie der Böse es will : Es entfiel meiner Tusche-Feder ein etwa 1 cm. kreisrund werdender Tropfen auf den Margo einer Seite, der aber gleich einige weitere Blätter durchfärbte. Mein erster Gedanke war Selbstmord ! Ich überlegte nur, ob mit KCN per os oder mit $C_3H_5(ONO_2)$ per detonationem. Denn ich hatte doch unbedingt-unversehrte Rückgabe im status quo ante zugesichert ! Entfleckung mit Cl-H_2O war erfolglos. Es war doch eine C-(Russ-) Tinte ! Das Gewissen schlug mir aber, wonach mich auch ein Selbstmord, in welcher Form auch immer, nicht davon entbinden könne, dem vertrauensvollen Leiher PAUL DORVEAUX, die offene Wahrheit über das Malheur sofort mitzuteilen und Entschädigung in jeder Form und Höhe anzubieten. Und das Unwahrscheinliche, es wurde wieder Ereignis : PAUL DORVEAUX tröstete mich in einem mild-liebenswürdigen Schreiben über das Malheur, es hätte keine Weiterungen auf sich, da der Fleck und dessen Durchschlag ja keinen Text bedecke, ich könne die Leihe unbesorgt wieder zurücksenden. Das kam mir armem Sünder wie ein Wunder vor ! Was Wunder, dass ich seither in förmlicher Liebe und erheblichem Respekt zu PAUL DORVEAUX aufblickte, was bis zu seinem Eingang in die Ewigkeit anhielt und bis zu meinem Exitus anhalten wird.

Ende 1937. Ich klagte DORVEAUX, der inzwischen seit seiner Emeritierung (1922) als Bibliotheksdirektor, archivalische Funktionen im Institut de France übernommen hatte, meine Not, dass in einer der grössten Berliner Bibliotheken die für meine Forschungen so wichtigen 10 Bände der „Procès verbaux de l'Académie des sciences (1795-1835)" nicht vorhanden seien. Sofort, am 6. Dezember 1937, antwortete er mir in einem, offenbar im Einvernehmen mit den Herren Sekretären der Akademie der Wissenschaften in Paris abgesandten Schreiben, wie folgt :

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(1) Vergl. : *Chemische Apparatur*, 1. Jahrgang, Heft 15, 10. März 1914, Seite 67-68, Fussnote 19, Schluss, in meiner Aufsatz-Folge : " Zur Vorgeschichte des Gegenstromprinzip-Kühlapparates."

Institut de France
Académie des Sciences

Paris le 3 février 1937

Mon cher Confrère,

Inactif d'écrire à M. Lecoin. Son discours n'est pas dans le courant. L'Institut le donne aux auteurs de nos Académiciens. Je ne reçois pas le courrier de l'Académie des Sciences alors si vous avez écrit poste.

Ma santé est toujours médiocre, je travaille depuis 3 semaines !

Est-ce le commencement de la fin ? J'ai vu dans ma 86ème année.

Votre tout dévoué

C. Dorveaux

Merci pour vos souvenirs.

Institut de France *Paris 6 déc. 1937.*
Académie des Sciences *Quai Conti no. 23.*

Mon cher Confrère,

Il est regrettable que la grande bibliothèque de Berlin, ... , ne possède pas les 10 volumes des Procès verbaux de l'Académie des sciences (1795-1835); mais il lui est facile de les avoir gratis. Le ..... directeur de cette bibliothèque n'a qu'à écrire une lettre de demande à Messieurs les Secrétaires perpétuels de l'Académie des sciences, et il obtiendra tout de suite cet ouvrage important.

Toujours à votre disposition, je vous prie d'agréer, mon cher Confrère, l'assurance de mes sentiments bien dévoués.

P. DORVEAUX.

A Monsieur le Docteur MAX SPETER, à Berlin.

Am 19. Januar 1938, zwölf Tage nach dem Hingange DORVEAUX's gingen die Bände von Paris ab. Dass sie mir bis heute (Juni 1938), noch nicht zugänglich sind, das ist nicht DORVEAUX's Schuld. In weiser Voraussicht hatte er mir jedenfalls eine für meine Arbeiten dringliche Stelle sogleich herausgeschrieben. *So war er; im besten Sinne: Edel, hilfreich und gut!*

Mancher bisher geduldige Leser wird nun fragen: Wer und was war denn dieser Mann? Solchen sei geantwortet, dass PAUL DORVEAUX, von Haus aus Mediziner (2), einer der besten und kenntnisreichsten medico-pharmaco-chemio-historischer Forscher war. Im „Supplément du Bulletin de la Société d'Histoire de la Pharmacie no. 38 (avril 1923)," einer Broschüre von 73 Seiten + 1 Seite Table des matières, sind (auf Seite 51-69) die „Publications du Docteur Dorveaux 1880-1923" verzeichnet, rund ein Viertel-Tausend. GUITARD (2) will diese DORVEAUX-Bibliographie noch komplettieren, er glaubt hierbei auf eine Anzahl von 300 Nrr. kommen zu können. Ich füge meinerseits einige Separata-Titel von Arbeiten DORVEAUX's, die er mir zusandte, zur vorläufigen Ergänzung an: Le Cervelet de VOLTAIRE et les MITOUART avec le portrait de PIERRE-FRANÇOIS MITOUART (*Bulletin de la Société d'Histoire de la Pharmacie*, Novembre

(2) Vergleiche: F. C. POGGENDORFF's Biographisch-Literarisches Handwörterbuch zur Geschichte der exacten Wissenschaften, Band IV, 1. Abth. Leipzig 1904, Seite 344, Spalte 2 und Band VI, 1, Leipzig 1936, Seite 595, Spalte 1. Die Daten in Band IV, 1, beruhen auf eigenen Mitteilungen DORVEAUX's. Nachruf E.-H. GUITARD's auf PAUL DORVEAUX in der Revue d'Histoire de la Pharmacie, T. 6, 1938, dem die letztveröffentlichte Arbeit DORVEAUX's " Une lettre de Bayen pendant la Terreur " angehängt ist.

1924-Février 1925, 20 Seiten); SIMON BOULDUC *(Revue d'Histoire de la Pharmacie*, 1930, 11 Seiten); GILLES-FRANÇOIS BOULDUC-ETIENNE-FRANÇOIS GEOFFROY *(Revue* etc., 1931, Seite 113-126); MITOUART et l'Académie Royale des Sciences etc. *(Revue etc.*, 1931, Seite 254-262); Les Membres et les Correspondants de l'Académie Royale des Sciences (1666-1793) Paris 1931, 265 Seiten in kl. 8°; GUILLAUME-FRANÇOIS ROUELLE *(Revue* etc., 18 Seiten); LOUIS-CLAUDE CADET (*Revue* etc., 1935, 26 Seiten); Notes sur la Famille Ridicule Comédie en Patois Messin, Metz, 1935, 14 Seiten in Gr. 8°; BALTHASAR-GEORGES SAGE (*Revue* etc., 1935, 31 Seiten); ANTOINE BAUMÉ (*Revue* etc., 1936, 9 Seiten); BERTRAND PELLETIER (*Revue* etc., 1937, 24 Seiten); Un Inventaire des Richesses de la Généralité de Metz fait en 1716-1717 par l'Intendant DE HARLAY DE CÉLY et publié par le Dr. PAUL DORVEAUX, Metz 1937, 10 Seiten. *Alles hervorragend exakte und Nova enthaltende Arbeiten!*

Und das war PAUL DORVEAU.

Sein Bild — das ich der Liebenswürdigkeit seines Eidams : MARCEL DELÉPINE, Professor am Collège de France und Mitglied des Pariser Instituts wie der Akademie der Medizin, verdanke — habe hier Platz (3).

Ein Faksimile seiner Handschrift, bemerkenswert durch seine Frage an das Schicksal — im April 1937, 3/4 Jahr vor seinem Dahingange — ob seine schwankende Gesundheit den Anfang vom Ende darstelle, sei hier wiedergegeben. Die Schrift ist nicht leicht leserlich, ich konnte sie — quasi mit Herz-Augen — sofort entziffern !

Und zum Schluss sei eine, von MARCEL DELÉPINE verfasste Todesanzeige wiedergegeben, die ein allgemein würdiges kulturhistorisches Dokument darstellt.

Priez pour lui !

Requiescat in pace !

Berlin. MAX SPETER.

(3) Es ist allerdings bereits 1923 *(im Bulletin de la société d'histoire de la pharmacie* no. 37, janvier) reproduziert worden !

Philosophy of Science and History of Science (*)

There has come into being of late a new and ambitious discipline known as the Philosophy of Science. Already possessed of its own periodicals and a respectable literature, this movement now projects a vast encyclopaedia of the sciences. Its ostensible purpose is to provide a sort of central discipline which will clarify scientific method, establish the distinctive criteria and objectives of science, and rid science of any residues of a metaphysical nature still attaching to it. These aims seem altogether praiseworthy; but when we examine more closely the literature of the movement, we find that they are really the excuse for a philosophical " reconstruction " of science not essentially different from the transcendental philosophy of the past. The logicians and epistemologists associated in the movement would of course deny this last statement. Their purpose, they would say, is precisely to free science from all metaphysic. None the less we must insist that their enquiries into the " foundations of science ", and their pursuit of a unified and consistent system of scientific hypothesis, are a revival of the old metaphysics, and constitute something very different from a criticism of scientific method and content. The antecedents of the movement are to be found in the Humian and Kantian philosophies; its characteristic feature is an exclusive preference for mathematically formulated knowledge; and its evident conclusion is a rejection of all science save physical theory. This conclusion is scarcely the result of an impartial appreciation of what is authentic in scientific knowledge, and valid in scientific method.

(*) This article is the substance of a paper read before the History of Science Society, and Section L of the American Association for the Advancement of Science, at Indianopolis, Dec., 30th, 1937.

The Philosophy of Science of which we are speaking is a highly specialized discipline. It engages logicians and epistemologists who have given special attention to the concepts of physical and mathematical theory, and physicists who have been led by contemporary problems in physical theory to a research into its " presuppositions." It is, that is to say, a collaboration of theorists, philosophical and physical; and in the light of their conclusions, the collaboration seems something of a conspiracy, in which physical theory and this philosophy of science will endorse each other at the expense of all other science. In any case, the conception of a purely logical and epistemological enquiry into scientific method, pursued in complete abstraction from the history of science, is an untenable conception, and one which is altogether injurious to science.

This new Philosophy of Science, because of its highly technical nature, will scarcely have direct influence on popular thought, although it may do considerable injury to science. This is not the case with a second movement, very widespread and influential in science and society, which also might be described as a philosophy of science. This second sort of philosophy has a host of disguises; its most explicit formulation is probably the dialectical philosophy which springs from HEGEL and MARX. Few to-day read HEGEL, and perhaps not many read MARX; but the essential dogmas of the dialectical philosophy enter contemporary science and thought in a number of ways, and begin to take control of the popular mind. Now what we have in both of these philosophies is a rationalistic or non-empirical metaphysic, disguising itself as a consummation of science. This revival of metaphysic should engage our scientific concern, for it is an overt or covert threat to the existence of empirical enquiry. By its substitution of metaphysical for empirical thinking, of introspective epistemology for observation of fact, and of dogma for hypothesis, it undermines empirical faith; and if it prospers, it must first weaken and finally destroy science.

If these philosophers of science, instead of confining their study to contemporary scientific theory, would turn their attention to the history of scientific progress, their often very great analytical powers would be usefully instead of harmfully employed. For it is not in extant theory, but in the whole evolution of science,

that the aims, criteria and largest concepts of science are to be seen. This historical study would also make clear the illegitimate nature of the purely logical or theoretical sort of analysis which they attempt. For science is an actuality, a part of the larger nature which includes human society; and no purely theoretical and non-historical study of natural fact can be held conclusive to-day. To maintain the contrary, and remain within a purely theoretical analysis, is simply to turn from an empirical study to some sort of metaphysical and transcendental discipline.

In order to make clear the illegitimate character of any such theoretical " philosophy of science ", let us note the significance of at least the largest outline of scientific progress. Science has progressed in two thousand years from a dominantly rationalistic enquiry to a thoroughgoing empiricism. It falls into three characteristic stages, the Greek, the modern and the contemporary. Natural science is now in the third stage; but speculation about science, such as comprises most philosophy, is still caught in the second stage, or hovers between this and the third.

Greek science was rationalistic, universalistic and transcendental. It was rationalistic because it thought to reach definitions absolutely certain in their truth, by way of an intellectual or " rational " insight, independently of the perception of fact. It was universalistic because it believed these definitions to describe a single universal form or structure, regulating all natural occurrence. And it was transcendental because it regarded this structure as something else than the changing actualities of particular occurrence. The structure lent its design to the particulars, but it was not identical with them. Greek science was little more than geometry and astronomy. Geometry presented certain axiomatic definitions, basic to analysis and construction. Astronomy discovered in the celestial motions certain geometrical applications. Greek science was empirical only in its expectation of finding the intellectually apprehended forms rudely illustrated in sensible fact. Discrepancy between the definable forms and particular fact was taken for granted. For the definitions did not derive from sensible experience—they derived from the reason.

We turn from Greek to modern science—to the science of the seventeenth, eighteenth and early nineteenth centuries.

Modern science repudiated the Greek transcendentalism, retained the Greek universalism, modified the Greek rationalism. It permitted no discrepancy between theory and particular fact. The structure defined by the theory was identified with the character of particular fact. But modern science was still universalistic in its faith that analysis could proceed from a few particular instances to a definition of universal laws. The induction might fall short of an absolute definition of natural structure, so that theories should be conceived as only approximate. But the structure so approximated was not conceived as variable. It was the fixed, immutable, universal goal of approximation. Finally, modern science was still rationalistic in its acceptance of self-evident mathematical and other very general axioms. It supposed however that science required, in addition to these absolutes, many hypothetical definitions contingent in their nature and reached by induction from observable particulars. We may say that modern science armed itself with mathematical and other axioms on the one hand, and with observation and hypothesis on the other, and proceeded to synthesize its axioms and observations into a theory of universal design. In its axioms it was rationalism. In its inductions it was empiricism.

This scientific attitude lasted into the mid-nineteenth century, when DARWIN in biology, supported by LYELL and others in geology, initiated a new sort of analysis. This new science was free of the rationalistic residue preserved from Greek science; it was non-transcendental in its pursuance of merely natural pattern; and it relinquished the universalism of earlier science in a way we must notice more closely. Earlier analysis had been, at least in its intention, exclusively theoretical. It proceeded, this is to say, from a distinction of certain typical and recurrent features—we will call them " types "—to a study of the relations among the types. This study produced definitions, and a further study of these definitions led to their synthesis in theories. Such a theory, once reached, was held to describe more or less closely the fixed structural pattern of nature. While scientific analysis started from different sorts of fact in different fields, and so proceeded to different theories in the different special sciences, those theories were vaguely considered to reach out always and everywhere to the same ultimate structural design in the world.

They might come more or less close to it—more closely in mathematical physics, less close in biology. But it was always one and the same natural structure they aimed at—a universal, eternal and immutable structure of natural law.

Now this conception DARWIN discredited by his demonstration of the variability of the organic species. If organic types change with time, the definitions relating them change too, and ultimately theory will be affected. The assumption of variations in natural species thus leads to the conception of natural structures as variable, and as peculiar to some spatio-temporal area of occurrence. The structure defined by biological theory, for example, evidently belongs to an evolution of organic form, which presumably originated in something like a point, and spread and differentiated itself to become the life on this planet. Biological structure is thus the property of an organic evolution—it is adjectival, that is to say, to a large and enduring but still individual progress. After DARWIN's disproof of the doctrine of fixed species, accordingly, biology became increasingly a genetic analysis; and this means that it everywhere added to its theoretical analysis of typical and structural character an historical enquiry discovering the temporal genesis and evolution of the types defined by its theories.

Contrast this genetic or historico-theoretical approach with the universalistic approach of pre-Darwinian science. That earlier science proceeded directly from an inspection of particulars to types and structures, ostensibly universal and eternal. The new science proceeds from observable particulars to large but still local and temporal units, described as evolutions. It professes no knowledge of universal and immutable form. In return for this modesty, it enjoys important advantages. It confirms its theoretical definitions by showing the entities defined by them to be objective and natural types, appearing at certain times and places, and enduring over certain periods and areas. In addition to a cross-section of the present, it has a long past as its field. It is a completely dynamic science, seeing in motion and change the most radical habit of nature, and recognizing constant and static structures for what they are—relative constants, or abstract aspects enduring just so long.

So has natural science progressed—from an almost pure ratio-

nalism identifying geometrical axioms with an immutable structure beyond nature, through an intermediate phase which read a universal law into every particular change, to a frank and full empiricism which makes universality a myth, generality a mental abstraction, and only particular fact real. Only since DARWIN, and only where a genetic and evolutionary analysis is employed, have we truly empirical science. But our recognition of this fact is obscured by a superstructure of philosophical ideas which we confuse with science, and which is the cause of a lag in our appreciation of what science is to-day. The earlier phases of science, the Greek and the modern, were as we saw not fully empirical. Their analysis of nature did not stand on its own feet, as does that of contemporary science. Consequently they had to be buttressed up by philosophical conceptions; and now that science has outgrown this scaffolding, we still try to retain it. In order to distinguish this philosophical context from science proper, let us observe the relation between science and philosophy in the Greek and modern periods respectively.

Greek science, we saw, thought to discern in particular and observable occurrence the forms defined by a purely intellectual intuition. But nature never quite lived up to the forms. Philosophy therefore postulated a duality of Form and matter. The Form was universal and eternal character, the matter was particular, local and changing character; and nature was their fusion. Notice that there was no problem of induction for this view! Universals were not supposed to be reached by a generalization from particulars. The universal definitions were known first and independently, by the reason, and only afterwards found to illuminate particular fact. It was not how the mind leaps from particular cases to general hypotheses, but how the objective Form of reality enters and informs the chaotic motion of nature, that Greek philosophy wondered at. Greek philosophy is thus quite irrelevant to modern speculation.

For modern science identified particular occurrence with the universal form or structure of nature. There might be no discrepancy between universal and particular character. The discerning eye sees, the conceiving intellect defines one and the same structure. The law of gravitation, said NEWTON, is a discernible fact and no mere hypothesis. Yet surely we distinguish

something when we distinguish particular and general character? DESCARTES neatly parried this conundrum. Particular and universal character, he suggested, are two versions of one and the same form. Where this form invests nature, we see it in particular character; and where it invests our minds, in axiomatic definitions, we know it as universal character. There is but one structure, spread out spatially in particular occurrence, and concentrated to a point in rational insight. DESCARTES' suggestion found acceptance; but it had a problem in certain non-mathematical definitions, which could not be regarded as axiomatic yet which claimed universality. The law of gravitation, for example, is not a self-evident truth—the fact that masses attract each other inversely as the square of their distance cannot be deduced from mathematics or logic. In such definitions science evidently moves to its universals from observed particulars, and cannot appeal to rational intuition. But by what right does one proceed from a few particular instances to a universal definition? On this problem of induction, modern philosophy was to be impaled.

The Englishman LOCKE was among the first to realize its radical nature. We suppose that science reaches universal propositions by induction from particulars; but should we not first enquire, he asked, whether the mind has this potency? Perhaps our definitions are only the summary of certain experiences. HUME pursued this enquiry to its conclusion. It is impossible, he showed, to induce universal definitions from particular instances. The notion of universal knowledge is a myth. This scepticism was aimed at a metaphysics claiming absolute truth; but it struck also a natural science which still claimed universality for its definitions. HUME's demonstration of the impossibility of a purely theoretical science of nature, reaching universal laws by induction from particulars, has never been seriously challenged. It is only in our own day, when in place of universal statements we set up general statements, defining only the more general and constant features of large particular evolutions, that the Humian scepticism is overcome.

Philosophers, however, have accepted all of HUME's arguments and none of his conclusions. Since theoretical analysis does in fact reach universal truth, they have supposed, the induction to universal statements must be valid; and if it cannot be grounded

in experience, it must be grounded in the theoretical form of thought itself. Henceforth, philosophers wrote books which they called " logic ", but which were really metaphysical speculations intent upon showing how the theoretical form proper to scientific exposition is really an objective structure, universal to nature. And it must be admitted that the apparent self-evidence and universal applicability of mathematical axioms supported until very recently this metaphysical dogmatism. KANT, for example, moved from this axiomatic character of mathematics to a " logic " which identified the theoretical form of scientific knowledge with the intelligible structure of objective reality.

It is from this meretricious " logic " that spring the philosophies of science of to-day. It was a " transcendental logic, " professedly penetrating below the specific inductions of the special sciences to a deeper and wider pattern of fact, definable in a universal and ultimate theory of being. To bring the diverse hypotheses of the special sciences into a unified system, a " reconstruction " of scientific theories was called for. This " reconstruction " might proceed in either of two directions. It might try to include the special sciences in a single comprehensive system, giving to each empirical hypothesis its proper place; or it might try to define a more abstract structure common to all the special sciences. The first method, organizing the special sciences into an ordered whole, was that of HEGEL, COMTE, SPENCER and others. A rather remarkable uniformity characterizes these conjectures as to the proper " order " of the sciences. From the most abstract theory, such as that of pure mathematics, science was supposed to proceed through physical and biological theory, to end up in psychological and sociological or philosophical theory. The unilinear direction of this movement, which relates each special science to all, was supposed to manifest an inexpugnable unity in human knowledge and in objective reality. HEGEL correctly perceived that this philosophical discipline, which orders the special sciences into a rigid system, uses another method than that of the empirical sciences themselves; and he distinguishes this method as " dialectic ", or super-logic. But COMTE and SPENCER and others did not clearly make this distinction. They supposed their metaphysical reconstruction to be merely an extension of the empirical method.

We can see to-day what motivated and made plausible this idea of a unified system of sciences. It was a premonition of that evolutionary science which was to reveal on the surface of this earth a passage from inorganic to organic form, and from vegetable and animal life to man and society. In that pre-Darwinian day, however, the notion of an actual temporal evolution could not be advanced. All the real types of nature, including the organic species, were supposed to be fixed and immutable, as elements in a fixed universal structure. It was possible to see that society is biologically conditioned, and life physically conditioned; but it was not possible to explain this fact by reference to physical nature as the more constant environment of evolving life, or by reference to organic nature as the antecedent condition of human life. The relations between society, life and physical nature had to be explained as fixed and eternal, or as somehow out of time. This was accomplished by the dialectic, or some other transcendental " classification of science."

But after DARWIN had appeared, and the relations between social and biological and inorganic fact could be empirically understood, the notion of a unitary system of knowledge still persisted. Its function was now, however, not to forerun, but to prevent an acknowledgement of the implications of evolutionary doctrine. By its insistence upon a single system of knowledge, pointing to an all-comprehensive and unchanging system in nature, it required the reduction of the evolutionary processes to universal and fixed laws, of which these processes were the local and temporal manifestation. The whole intention of the evolutionary hypothesis, which was to explain the types and structures of nature as only relative constants in an evolutionary process, was thus defeated. And where it was defeated, the old conception of a universal theoretical analysis, moving to a metaphysic definitive of the eternal structure of reality, could be maintained. To the empirical scientist, and to those who believe in the empirical method, this philosophy of science must be anathema. Its whole conception of universal and static structure is hostile to empirical procedure, its whole intention is to allow to the metaphysician a ruinous authority over empirical science. It is obligatory upon the special sciences to proceed to such hypotheses as the facts call for, without respect to a metaphysical system which would

confine all hypothesis within rigid limits of its own choosing.

This notion of a philosophy of science, allotting to each empirical discipline a place within its own "reconstruction", does at least give some room to the organic and social sciences. This is not the case in the more specialized Philosophy of Science which has just come into vogue. Here the " reconstruction " offered by the philosophers seeks to distinguish a structure common to all the special sciences, rather than a system linking them into an ordered sequence. Such a reconstruction should abstract from the special content of empirical science, which varies from one science to another; and this abstraction the philosopher professes to make. In reality, however, he confines his study to physical science, under the vague and nowhere justified assumption that organic and other theory must ultimately reduce to physical theory. He follows here the procedure of KANT, who believed that the most basic postulates of physical theory define characters which are essential to sensory perception, so that all further analysis must necessarily proceed from them. The temporal dimension of perceived occurrence KANT associated with arithmetical, the spacial with geometrical axioms; and he accordingly supposed that all science would be mathematical in character. This dogma, which has been antiquated by psychological study and which is no longer supported by physical science itself, is retained in the new Philosophy of Science. Since KANT, however, the geometrical elements in physical theory have been shown to be contingent and hypothetical; while logical analysis has seemed to show that what is not contingent and hypothetical in mathematical theory, or in any other theory, is merely the symbolic conventions necessary to any consistent exposition. These conventions regulate human expression, but they are in no sense definitive of nature; and they are to be subordinated in every analysis to the demands of the special subject-matter analysed. They are no more universal or ultimate or authoritative, accordingly, than the empirical analysis from which they are abstracted. Henceforth, logic and mathematics must follow empirical investigation; they cannot precede or regulate it.

Now one can very well understand why the philosopher should ignore these recent developments in science and logic. They invalidate the whole conception of a philosophical reconstruction

of science; and to appreciate them is to relinquish the past ambition of philosophy to reach a simple, universal and authoritative system of knowledge. But why should the physical scientist cooperate in this effort to ignore the teachings of science? The reason is not hard to see. Physical science has been little affected as yet by evolutionary conceptions. It still proceeds with its inductions of universal definitions from one or a few particular instances. It makes no effort to confirm the types thus defined by means of a genetic study of their origin and distribution. It recognizes the hypothetical and approximate character of its definitions; but the structure which is so approximated is still supposed to be universal, eternal and immutable. Physical theory is still in the second phase of science, that which we designated as "modern." It consequently still stands in need of a metaphysical discipline, establishing the reality of the universal and immutable structure it assumes. For the assumption of this structure is the premise and justification of its universalistic inductions. Only if there is such structure is the movement from particular instances to universal definitions justifiable. The question is, which shall science be? Shall it remain what it was in the past, a purely theoretical discipline moving to universal statements by induction from isolated particulars, and justifying this method by a metaphysical appeal to a single and uniform structure investing all fact; or shall it advance to become an historico-theoretical discipline, confirming its generalizations by an empirical recovery of the particular evolutions bearing the general character, and pretending to no knowledge of a "universe" lying beyond these?

It is empirical science itself, and not philosophy or logic, that will answer this question; and there is little doubt what the answer will be. For a time the metaphysics of the past may be artificially revived; but the whole weight of empirical enquiry is against it, and only if science fails can it succeed. For some time yet there will be physicists wedded to the old dogma that mathematical and physical theories proceed straight to a definition of the universal and ultimate structure of nature, and willing to cooperate with the metaphysician to maintain this delusion. But it is already apparent that physicists in general incline in another direction. It is clear, they begin to tell us, that the definitions

advanced by physical theory are in large measure descriptive of the intellectual and manual operations involved in experimental analysis, so that they do not, as they stand, comprise a definition of natural motion. This conclusion is supported by an historical consideration of the long evolution of physical science. Physical theory in Greece was primarily the application of geometrical definitions to the movements of the sky. These definitions, purporting to set forth the properties of plain and solid figures, were in truth a summary of the procedures by which the figures were constructed. But because the rotation of the earth gave to every celestial motion an appearance of circularity, the geometry which defined the circle was mistaken for a code of celestial law. Later, mechanical models were added to the static geometrical figures; and now the stereotyped operations which produced the mechanical movements were confused with the laws of natural motion. Experimental chemistry next elaborated a theory defining certain processes of laboratory reaction initiated by the chemist; and these and other experimental procedures were brought together and synthesized to constitute the elaborate physical theory of to-day. It is no wonder that the contemporary physicist finds operational conventions lurking within his definitions of experimental fact. Physical science has never been anything else than this study of experimental procedures and constructs; physical theory has never been anything else than this elaborate and ingenious code of regulations, defining how anyone may undertake the initiation and analysis of experimental procedure. Physical theory is the handbook of this experimental technique, the manual of this art or technology. It is not a definition of the processes which constitute nature. Its results, apart from their aesthetic and practical value, are of value to natural science only when, in geology and elsewhere, they are made auxiliary to a study of the processes by which nature itself produces its specific and individual character at any time and place. But we must understand this relation of experimental theory to natural science correctly. Geology does not exist to interpret geologic fact as a manifestation of physico-chemical theory. It exists to reconstruct the evolutionary movement of the earth's surface, using such concepts as it finds useful; and it turns to physical theory only as an implement in this enquiry.

The constants of geologic evolution are not the constants defined by physical theory.....

We see then that physical theory, after all, finds the confirmation of its definitions in a genetic or historical study, revealing the origin and evolution of the types defined. These types are conventional modes of experimentation; and they may be seen to arise and evolve in the evolution of experimental science itself. Physical theory, in short, summarizes the structure of the evolution of experimental technology. It has no direct reference to any structure in the external world.

These are some of the lessons taught by the history of science. These lessons justify our faith that geology, biology and other historico-theoretical sciences attain to authentic natural knowledge. They confirm and clarify the empirical emphasis on particular fact. They wean us from any illusion as to a universal and eternal structure in nature, accessible to a purely theoretical analysis. In this way they liberate us from the temptation to backslide into a non-empirical and metaphysical philosophy, professedly leading to an authoritative and super-empirical truth. The only authentic natural knowledge, we see, is that of the empirical sciences themselves; and no logic, metaphysic or philosophy of science can be more than an abstraction from and a distorted stereotype of some part of this empirical knowledge. If the empirical sciences are radically plural, their plurality argues a plurality in nature. If an empirical science needs " reconstruction, " this reconstruction can be effected only by the empiricist working in that field, he alone being competent to define the character of his subject-matter, its methodological implications and the criteria of truth proper to it. We would not disbar philosophy from all activity. We would direct it to its proper subject-matter, which is the evolution of human thought and its concepts. But this study, to be authentic, must also be empirical; and this means that it will start from and remain within a historical retrospect upon the progress of science, and subordinate its theoretical definitions to the evidence of this history.

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The Aristotelian Explanation of the Rainbow

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I.—Introductory remarks

The rainbow was a subject of frequent study by many medieval writers, both in the Moslem and in the Christian worlds. One important reason for this, no doubt, is that Aristotle's thoughts on the subject were available. In the Darulislam his authority had been challenged by Ibn Sīnā (d. 1037) and Ibn al Haitham (d. 1039), but their views and especially those of the former were not very different from those of Aristotle.

Aristotle (1) knew the causal relationship between the existence of water droplets in the atmosphere and the production of the rainbow. He knew the geometrical uniformities involved in the relative positions of the sun, the observer and the bow. These are two important steps towards the complete explanation of the rainbow and we see them already accomplished by him. We find a great number of observed facts already collated, and most of them are correct. Aristotle's explanation of the rainbow also contains a geometrical scheme of approach in accounting for

(1) By Aristotle I simply mean the author of the Aristotelian works used by me.

the shape of the rainbow. We thus find that ARISTOTLE had progressed far towards a scientific explanation of the rainbow and was not merely in the preliminary stages of an investigation of this nature. This can be made clear by a comparison with the Chinese studies on the rainbow (see appendix). On the other hand, of course, ARISTOTLE must not be regarded as having originated all his explanations. He must have learned a great deal from the earlier philosophers; as a matter of fact he refers to statements of *ancients* (ἀρχαῖοι) [Met. 372ª22] (2) concerning the rainbow.

II.—ARISTOTLE'S THEORY OF COLOR

Color is the special object of sight [De an. 418ª13]. Each sense perception involves a medium besides the object of perception. [De an. 419ª25-30, 435ª18, 423ᵇ26, 422ᵇ22]. For sight this medium is the pellucid or the diaphanous. Color has the power of throwing the actually pellucid into movement [De an. 419ª10], and it is this excitation of the pellucid that explains the visibility of color. The color of a body is the limit, the boundary of the diaphanous in that body, and, since the boundary of the diaphanous in a body coincides with the boundary of the body, the color of the body is also the limit or the boundary of the body itself. This is the color *seen*; the same nature extends right through the body [De sen. 439ª34-439ᵇ2, 439ᵇ9-15], for the pellucid penetrates all bodies to a greater or less extent [De sen. 439ᵇ9,10]. Besides being a medium between the colored object and the eye, the pellucid is the substratum for the manifestation of color. The diaphanous is a common characteristic of air and water (two of the four elements) and of many solid bodies. Pellucidity, however, is an attribute of no

(2) ARISTOTLE's views on the rainbow are presented in the *Meteorologica*. I have used its translation into English by E. W. WEBSTER (Oxford, 1923). The Greek edition of this work by F. H. FOBES (Cambridge, Mass., 1919; *Isis* 3, 278-79) was referred to. Other sources which I have used are : *De anima*, transl. by J. A. SMITH (Oxford, 1931); *De sensu*, transl. by G. R. T. ROSS (Cambridge, University Press, 1906); EDWIN WALLACE, *Aristotle's Psychology* (Cambridge 1882); *De caelo*, transl. by J. L. STOCKS (Oxford 1922). The Aristotelian quotations in my text are taken from these translations.

element except the ether. Air and water are pellucid, because, apart from their specific properties, pellucidity inheres in them as a common property [De an. 418^b 4-10].

The pellucid, when only potential, is colorless and dark. It becomes actual through fire. The presence of fire causes the existence of light, its absence that of darkness or privation of light [De an. 418^b10-15].

Light and darkness or white and black, when mixed produce the other colors. Red contains more white and less black than the other colors; green has more black and less white than red, and violet possesses still more black and less white. The above statement is equivalent to saying that as light gets gradually weaker or darker, the colors are produced in succession. Or, expressing this view in terms of the theory of visual rays, colors are produced by the weakening of sight.

ARISTOTLE considers that the rainbow contains three colors : red, green, and violet. He sometimes also mentions yellow (or orange), but this color is not to be considered in the same class as the three mentioned above; it is due only to contrast. Red, green and violet are the primary, the basic colors: they are real. This tradition of considering only three colors as basic and real continued for a long time and remained unchallenged in the Aristotelian form until THEODORICUS OF FREIBERG (beginning of the fourteenth century). There are arguments of ARISTOTLE for the justification of his considering the above mentioned three colors as the basic and the only real ones. These can be classified as : *a*) mystical or philosophical; *b*) arithmetical; *c*) experimental.

a) When sight becomes less white, i.e., when sight is weakened and approaches black (i.e. departs from white) the colors are produced. " When sight is relatively strong the change is to red; the next stage is green, and a further degree of weakness gives violet. No further change is visible, but three completes the series of colors (as we find three does in most other things), and the change into the rest is imperceptible to sense. Hence also the rainbow appears in three colors; " [Met. 374^b 31-375^a1]. The following quotation will make clear how three completes the series of most things : " Now a continuum is that which is divisible into parts always capable of subdivision, and a body

is that which is every way divisible. A magnitude if divisible one way is a line, if two ways a surface, and if three a body. Beyond these there is no other magnitude, because the three dimensions are all that there are, and that which is divisible in three directions is divisible in all. For as the Pythagoreans say, the world and all that is in it is determined by the number three, since beginning and middle and end give the number of an ' all,' and the number they give is a triad. And so having taken these three from nature as (so to speak) laws of it we make further use of the number three in the worship of the gods. Further we use the term in practice in this way. Of two things, or men, we say ' both,' but not ' all ' : three is the first number to which the term all has been appropriated. And in this, as we have said, we do but follow the lead which nature gives. Therefore, since ' every ' and ' all ' and ' complete ' do not differ from one another in respect to form, but only, if at all, in their matter and in that to which they are applied, body alone among magnitudes can be complete. For it alone is determined by the three dimensions, that is, is an ' all '." [De caelo, 268^a 7-23].

b) " Firstly white and black may be juxtaposed in such a way that by the minuteness of the division of its parts each is invisible while their product is visible and thus color may be produced. This product can appear neither white nor black, but, since it must have some color and can have neither of the above two, it must be a sort of compound and a fresh kind of tint. In this way then, we may conceive that numbers of colors over and above black and white may be produced and that their multiplicity is due to differences in the proportion of their composition. The juxtaposition may be in the proportion of three of the one to two of the other, or three to four or according to other ratios. Others again may be compounded in no commensurate proportion, with the excess of one element and deficiency of the other which are incommensurable, and color may, indeed, be analogous to harmonies. Thus those compounded according to the simplest proportions, exactly as is the case in harmonies, will appear to be the most pleasant colors, e.g. purple [*ἁλουργόν*], crimson [*φοινικοῦν*] and a few similar species. (It is exactly the same reason that causes harmonies to be few in number). Mixtures

not in a calculable ratio will constitute the other colors. Or again, all tints may show a calculable proportion between their elements, but in some the scheme of composition may be regular in others not, while then those of the latter class are themselves impure, this may be due to an absence of calculable proportion in their composition." [De sen. 439^b 21-440^a 6].

c) " In the inner rainbow the first and largest band is red [*φοινικία*] : in the outer rainbow the band that is nearest to this one and the smallest is of the same color. The other bands correspond on the same principle. These are almost the same colors which the painters can not manufacture : for there are colors which they create by mixing, but no mixing will give red [*φοινικοῦν*], green [*πράσινον*] or purple [*ἀλουργόν*]. These are the colors of the rainbow, though between the red and the green an orange color is often seen." [Met. 372^a 2-9].

In the English versions there is no consistency in the translation of the color names used by ARISTOTLE as we would expect, since color names are vague in both languages. However, it must be noted that ARISTOTLE is consistent in the words he used for the three basic colors. This fact justifies the coordination made above between the different ways of ARISTOTLE's approach to the subject of the three colors. Other passages where the names of the three colors are mentioned are Met. 374^b 33, 375^b 11 etc.

" ... if the principles we laid down about the appearance of colors are true the rainbow necessarily has three colors, and these three and no others. The appearance of yellow is due to contrast, for the red is whitened by its juxtaposition with green. We can see this from the fact that the rainbow is purest when the cloud is blackest; and then the red shows most yellow. So the whole of the red shows white by contrast with the blackness of the cloud around : for it is white compared to the cloud and the green... But the moon rainbow affords the best instance of this color contrast. It looks quite white : this is because it appears on the dark cloud and at night." [Met. 375^a 4-20]. It is implicit in the above statement that yellow is nearer to white than red. Here are some other statements of ARISTOTLE concerning color contrast : " ... just as fire is intensified by added fire, black beside black makes that which is in some degree white look quite white. Bright dyes too show the effect of contrast. In woven and em-

broidered stuffs the appearance of colors is profoundly affected by their juxtaposition with one another (purple, for instance, appears different on white and on black wool), and also by difference of illumination. Thus embroiderers say that they often make mistakes in their colors when they work by lamplight, and use the wrong ones." [Met. 375^{a} 20-28].

We have seen that colors are produced by the mixture of white and black or by the weakening of sight or light. As will be seen from the quotations to follow, this weakening occurs in three ways : *a*) reflection; *b*) distance; *c*) degree of opacity or darkness of the reflector. Aristotle mentions a number of phenomena or observed facts which he considers as related to the rainbow. Most of these are used mainly to justify his general color theory. This also can be seen from the quotations given below.

Rainbows are seen around the lamps, in winter, generally with southerly winds. Persons whose eyes are moist see them most clearly because their sight is weak and easily reflected (3). [Met. 374^{a} 19-22]. The formation of colors in this sort of bow is " due to the moistness of the air and the soot which the flame gives off and which mixes with the air and makes it a mirror, and the blackness which the mirror derives from the smoky nature of the soot." [Met. 374^{a} 23-27].

" We know how red the flame of green wood is : this is because so much smoke is mixed with the bright white firelight : so too the sun appears red through smoke and mist." [Met. 374^{a} 5-7].

" At all events, that [sight is strained and fails] is the reason why distant objects and objects seen in a mirror look darker and smaller, and smoother, and why the reflection of clouds in water is darker than the clouds themselves. This latter is clearly the case : the reflection diminishes the sight that reaches them. It makes no difference whether the change is in the object seen or in the sight, the result being in either case the same... Clearly, then, when sight is reflected it is weakened, and as it makes dark look darker, so it makes white look less white changing it and bringing it nearer to black." [Met. 274^{b} 18-30].

(3) It is interesting to compare this with the following statement of IBN SINĀ : The cause of this is due to the dampness of the eye, because when the eye is rubbed one sees this image no more. (HORTEN and WIEDEMANN, Avicennas Lehre vom Regenbogen, *Meteorol. Zeitschrift*, 30, 540, 1913).

" They [rainbow and halo] are both reflections, but the rainbow is distinguished by the variety of its colors. The reflection in the one case is from water which is dark and from a distance; in the other from air which is nearer and lighter in color." [Met. 373^b 34-374^a 4].

In view of the later developments of the color theories and of the explanation of the rainbow, the weakening or darkening of sight or light and therefore the production of color by reflection as considered by ARISTOTLE, is worthy of special notice. The gradual transformation of this point of view, later, was destined to play an important role in ushering in one of the most significant advancements made in the explanation of the rainbow, in the early fourteenth century. Change of emphasis from reflection to refraction as a cause of production of color, or rather the complete dismissal of reflection led to the successes of KAMĀL AL DĪN AL FĀRISĪ (d. ca. 1320) and THEODORICUS OF FREIBERG (d. after 1310). Introduction of refraction (without, however, having much effect as far as the production of color is concerned) in the explanation of the rainbow can be seen implicitly in IBN AL HAITHAM and IBN SĪNĀ, and also in the latter's followers, such as SHAHĀB AL DĪN AḤMED AL QARĀFĪ (d. 1283-86) and ZAKARĪYĀ IBN MUḤAMMED AL QAZWĪNĪ (d. 1283). The introduction of refraction is explicit in the case of WITELO. ARISTOTLE also considers refraction as effective in the production of color : " white light through a dark medium or on a dark surface (it makes no difference) looks red." [Met. 374^a 3-5]. However his whole emphasis is on reflection.

The word used by ARISTOTLE which is translated as *reflection* is ἀνάκλασις. BARTHÉLEMY SAINT-HILAIRE (*Météorologie d'Aristote*, 1836) translates this word as *refraction*, but more recent works (E. W. WEBSTER, 1923) use the word *reflection*. In the case of rainbow at any rate, the diagram [375^b] (see FIG. 4) leaves no doubt that what is meant is *reflection*. For both the incident ray and the ray produced after ἀνάκλασις are on the same side of the surface on which ἀνάκλασις occurs. Statements such as the following suggest strongly that haloes are produced by *reflection* also, and not *refraction* : " The cause of them all [halo, rainbow, rods, mocksun] is the same, for they are all reflections (ἀνάκλασις). But they are different varieties, and are distin-

guished by the surface from which and the way in which the reflection (ἀνάκλασις) to the sun and some other bright object takes place." [Met. 372ª 17-21]. " So the rainbow always appears opposite the sun whereas the halo is round it. They are both reflections (ἀνάκλασις), but the rainbow is distinguished by the variety of its colors. The reflection in the one case is from water which is dark and from a distance; in the other from air which is nearer and lighter in color." [Met. 373ᵇ 34-374ª 4].

In *De anima* and also in *De sensu* ARISTOTLE consistently treats light as being transmitted from the source to the eye. [De an. II, 7], [De sensu 437ᵇ 10-438ª 5]. This is also the case for the impulses received by the other sense organs [*De anima*]. Here are some statements : color " moves the pellucid substance, for instance the air, and it is through this as it extends from the object to the sense that motion can be communicated to the visual organ." [De an. 419ª 13-15]. Light " never ceases to be reflected : otherwise there would not be everywhere light, but (with the exception of that spot on which the sun's rays directly fall) darkness." [De an. 419ᵇ 30]. ARISTOTLE actually rejects the theory of visual rays, which he says EMPEDOCLES sometimes uses, by the following argument : if, he says, vision were produced by the issuing forth of light from the eye as it were from a lantern, why does not sight function in the dark as well as by day? [De sen. loc. cit.]. On the other hand, however, in the parts on the rainbow of the *Meteorologica* ARISTOTLE uses the theory of visual rays himself. The result is that some scholars have described ARISTOTLE as a proponent of the theory of sensible emanations while others have credited him with the opposite view. [EDWIN WALLACE, *Aristotle's Psychology*, p. LXXII]. ARISTOTLE clearly is inconsistent in this aspect of his theory of vision. This inconsistency may be reconciled to a small extent, when one has in mind that ARISTOTLE's idea of *propagation* of light, as is put forth in *De anima* and *De sensu*, is not what the word propagation means to us today. In the Aristotelian conception of the propagation of light, or transmission of the impulse from the source of light to the eye, no velocity is involved. It is instantaneous, as the statements below show :

" EMPEDOCLES (and with him all others who used the same forms of expression) was wrong in speaking of light as ' travelling '

and being at a given moment between the earth and its envelope." [De an. 418^b 20-25]. "Light travels instantaneously." [De sensu 447^a 10]. In parts 446^a 20-447^a 12 of *De sensu* one finds arguments against the theory that light possesses a measurable velocity or even that light has a motion. So that, it seems, we must form a picture of propagation which is not dynamic, but static. "Light is due to the presence of something but is not a motion." [De sen. 446^b 30].

On page 375^b (WEBSTER) a diagram is given showing the primary and the secondary rainbows with their colors in reversed order (as they really occur). ARISTOTLE says, "the reflection from the outer rainbow is weaker because it takes place from a greater distance and less of it reaches the sun, and so the colors seen are fainter... Three rainbows or more are not found because even the second is fainter, so that the third reflection can have no strength whatever and cannot reach the sun at all." (4) [Met. 375^b 1-15].

III.—EXPLANATION OF THE ORDER OF THE COLORS IN THE PRIMARY AND THE SECONDARY RAINBOWS

S = sun;
O = observer;
VGR = a radial cross section of the secondary rainbow;
V = location of violet;
G = location of green;
R = location of red.

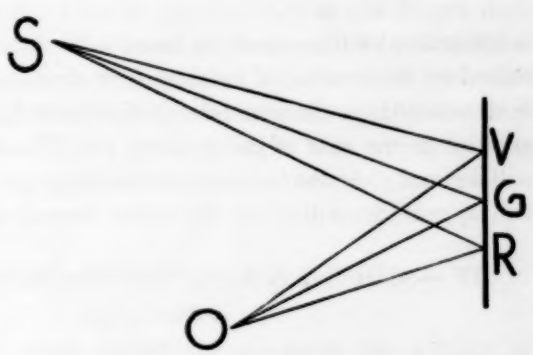

FIG. 1.

ARISTOTLE says since OR<OG<OV, the reflection at R will be strongest, that at V will be the weakest; and the reflection at G

(4) IBN SINĀ puts this more in the form of a probability; he says: the secondary rainbow is already barely visible; so how can a third one appear? When I say it cannot appear, I do not mean that it is impossible, but that it is very unlikely to occur. (HORTEN and WIEDEMANN, *loc. cit.*, p. 542).

will be stronger than that at V but weaker than that at R. [Met. 375^b 3-9]. He had already told us that as sight gets weaker the color will depart from white and approach black. Hence red will appear at R, green at G and violet at V. All this is logical and consistent with his color theory. But if this reasoning be adopted in explaining the order of the colors in the primary bow, the order of colors will not come out as they are observed, but in a reverse order. So in the case of the primary bow, ARISTOTLE has recourse to an entirely different way of approach in order to explain the order of the colors. Here distances such as OR, OG, OV do not play any role. What is of importance is the total amount of reflection from each circular band. If we consider the sum total of the reflected sight in each of these bands, this sum is a function of the size of the band. We know that color is determined by the amount of brightness or darkness, or, in other words, is dependent on the amount (5) of reflected sight. This amount is greatest in the case of the greatest arc. Therefore the outer circle will be red. At the second and the inner circles green and violet will appear according to the same reasoning. [Met. 375^a 1-4].

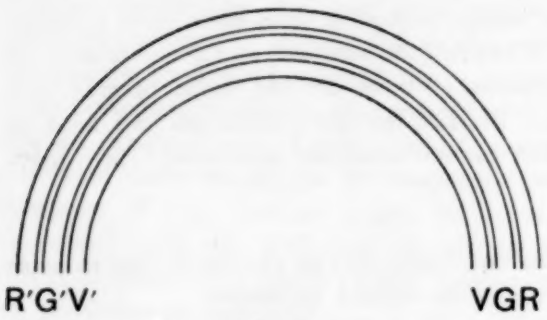

FIG. 2.

IV.—SOME OTHER FACTS AND UNIFORMITIES OBSERVED BY ARISTOTLE

" The rainbow never forms a full circle, nor any segment greater than a semicircle. At sunset and sunrise the circle is

(5) " The amount of reflected sight " apparently means the amount of sight that remains after reflection, or the amount that is not lost by reflection. Here again ARISTOTLE is at variance with his earlier specific and detailed statements on the production of color and, as a result, is inconsistent. Before (see p. 68) he talked about the ratio of two quantities, now he is dealing with the magnitude of only one of the quantities of the ratio.

smallest and the segment largest... There are never more than two rainbows at one time. Each of them is three colored; the colors are the same in both and their number is the same, but in the outer rainbow they are fainter and their position is reversed. In the inner rainbow the first and the largest band is red; in the outer rainbow the band that is nearest to this one and smallest is of the same color : the other bands correspond on the same principle." [Met. 371^b 26-372^a 5]. The rainbow that is seen when oars are raised out of the sea involves the same relative positions as that in the sky. [Met. 374^a 30-32]. We get a rainbow, too, if a man sprinkles fine drops in a room turned to the sun so that the sun is shining in part of the room and throwing a shadow in the rest. Then if one sprinkles in the room, another, standing outside, sees a rainbow where the sun's rays cease and make a shadow. Its nature and color is like that from the oars and its cause is the same, for the sprinkling hand corresponds to the oar. [Met. 374^b 1-7]. The sun, the observer and the center of the bow are on the same line. [Met. 377^a 1-4]. The rainbow is a semicircle when the sun is on the horizon. [Met. 376^b 21]. The segment is smallest when the sun is on the meridian. [Met. 377^a 9]. " In the shorter days after the autumn equinox there may be a rainbow at any time of the day, but in the longer days from the spring to the autumn equinox there cannot be a rainbow about midday." Although the content of the last quotation is correctly explained the explanation is only qualitative and therefore incomplete. [Met. 377^a 10-29]. The value of the angle MKΠ (see Fig. 4) apparently was not known to ARISTOTLE.

V.—ARISTOTLE'S KNOWLEDGE OF REFLECTION

There is no book where ARISTOTLE discusses the subject of optics systematically. In *De anima* and *De sensu* one finds philosophic discussions about the nature of light and of colors and about the processes of vision. AL NADĪM (d. 995) mentions in his *Fihrist* a book on the mirror by ARISTOTLE, but apparently this is a mistake. [HEINRICH SUTER, Fihrist des IBN ABI JAKUB AN NADIM, *Zeitschr. für Math. und Physik*, 37, 349, 1892]. ARISTOTLE's knowledge of reflection can, however, be deduced

from the content of the part of *Meteorologica* where he discusses the rainbow and the halo. ARISTOTLE does not as yet have the conceptual scheme of study which constitutes the geometrical optics, except for dealing with rays as straight lines. He does not talk about the normal to the surface of the mirror, and he does not talk about angles. He only considers that there is a fixed ratio between the lengths of the incident and reflected rays. This is seen both in his explanation of the halo [Met. 373^a 4] and of the rainbow. [Met. 376^a]. ARISTOTLE knows that a uniformity is involved in the reflection of light : " Since the reflection takes place in the same way from every point..." [Met. 373^a 3], " we must accept from the theory of optics the fact that sight is reflected from air and any object with a smooth surface just as it is from water..." [Met. 372^a 29-31]. He knows that there is a law according to which reflection takes place, but he does not know, and also, perhaps does not feel the need of knowing the specific form of the law itself. He knows that if light (or sight) proceeding from K is to be reflected from the surface Q to the point H, there is a unique point M from which this reflection must take place; and that any other path such as KPH will not do. [Met. 376^a, 376^b, 376^b 1-4]. But he does not know the correct way of determining the point M : in the diagram on p. 375^b (WEBSTER) of *Meteorologica* the incident ray is normal to the surface of the mirror, and yet the reflected ray is not on the same line (see FIG. 4). According to ARISTOTLE if M is a point where reflection from K to H can occur, then this reflection is determined by the ratio $\frac{KM}{MH}$. The point P cannot reflect

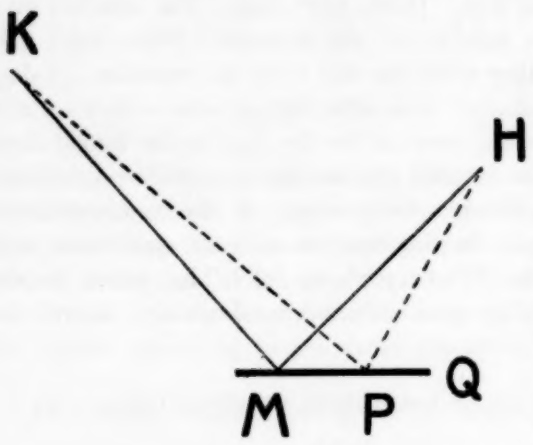

FIG. 3.

light from K to H, because $\frac{KP}{PH} \neq \frac{KM}{MH}$. Besides mentioning the existence of a regularity in the reflection of light, ARISTOTLE makes use of the regularity (which is as given above, in specific form) in accounting for the shapes of both the rainbow and the halo, and this regularity is the most essential point in the explanation of the shapes. On the other hand, however, in some places where his main concern is not the manner in which light is reflected he contradicts himself (e.g., see the quotation on pp. 73-74).

VI.—THE SHAPE OF THE RAINBOW

ARISTOTLE deals with the explanation of the shape of the rainbow on pp. 375^b, 376^a, 376^b and 377^a of *Meteorologica* and two diagrams accompany the text (WEBSTER). That the shape of the rainbow is necessarily circular is proved by geometry. The geometrical details are circuitous and far from elegant. F. POSKE has made a detailed study of this part. [Die Erklärung des Regenbogens bei ARISTOTELES, *Zeitschr. für Math. und Physik*, 27, 134, 1883]. In the diagrams the observer is at the center of a sphere. The sun and the cloud on which the reflection giving rise to the rainbow occurs are both on the surface of this sphere. It is not clear exactly what this sphere represents, and the solar rays are not parallel to each other, so that the sun is treated as at a finite distance. The sun and the rainbow are represented as equidistant from the observer. There are a few other difficulties (WEBSTER, footnote on 375^b, 376^a) with the first one of these diagrams (FIG. 4) : on p. 375^b the text gives one the impression that the circle part of which is dotted is the horizon, whereas 376^b 20, 21 sounds as if MPH is the horizon. Another mistake in the details of the diagram is that $\angle$ KΠM should be greater than a right angle, whereas in the diagram it is smaller.

Apart from its minute details ARISTOTLE's explanation of the shape of the rainbow may be put together in the following way : if a mirror is so small that its periphery cannot be distinguished, so small that it is not divisible for sense, then such a mirror cannot reproduce the shape of an object. If the shape

of the object is reproduced then the mirror must be sensibly divisible, since divisibility is involved in the notion of figure. In small mirrors such as these, where figure is not reflected, colors are reflected. The colors of the object are sometimes reflected as they are, but other times, either owing to the admixture of the color of the mirror or to the weakness of sight, a different color appears. [Met. 372^{a} 29-372^{b} 9]. Here are some quotations : " The mirrors [the water droplets] must be thought of as contiguous : each of them is too small to be visible, but their contiguity makes the whole made up of them all to seem one. The bright band is the sun, which is seen as a circle, appearing successively in each of the mirrors as a point indivisible to sense." [Met. 373^{a} 19-24]. " Since each of the mirrors is so small as to be invisible and what we see is the continuous magnitude made up of them all, the reflection necessarily gives us a continuous magnitude made up of one color; each of the mirrors contributing the same color to the whole." [Met. 373^{b} 24-28]. If there are a great number of such small mirrors isolated but all close to each other then a composite image will be formed out of each individual shapeless image. In this way the shape of the whole image will not be the same as that of the object. This first step aims to explain away the difficulty that if the rainbow were the image of the sun, then this image should be a full circular disc, i.e., the same in shape as the sun. After thus relieving the mind of the apparent conflict between the assumption that the rainbow is an image by reflection and the observed fact that this image does not have the shape of the object, ARISTOTLE arrives at the next

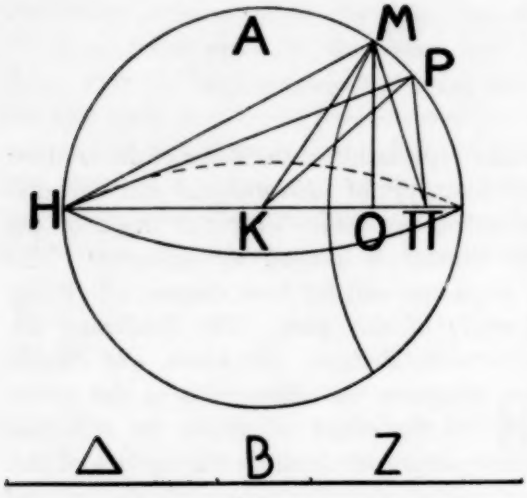

FIG. 4.

stage of his proof which is to explain why the rainbow has the shape of an arc. This is done by taking into account the fact that reflection occurs according to a law, and that only a certain region of a mirror comes into play in transmitting the image of a fixed object to an observer in a given location. Consider any plane passing through the point of observation and the sun, and consider the intersection of this plane with the surface of the mirror (the cloud). A radial section of the rainbow is a small part on this line.—And it is an observed fact that this section on the mirror is functional in transmitting an image to the observer. Let us call this section *mn* for convenience.—ARISTOTLE uses a single point instead of *mn* (M in FIG. 4). Now if it is a geometrical uniformity which determines the location of this section, then the locus of all parts *mn* would give the rainbow. The uniformity involved in reflection is geometrical according to ARISTOTLE. Therefore the locus of all parts *mn*, which is the totality of all *mn* on all the planes which pass through the sun and the observer, and which are normal to the surface of the mirror (because the plane passes through the center of the sphere), will give the shape of the rainbow, and this locus is a circular belt. This locus is obtained by rotating HMK around HK as axis (see FIG. 4). The geometrical treatment in ARISTOTLE, studied by POSKE, is for the purpose of showing that this locus is a circle. The details of this part are, according to POSKE, for the purpose of reducing the explanation of the shape of the rainbow to the explanation of the shape of the halo; i.e., ARISTOTLE seeks to substitute for two cones (with apexes at H and K) the openings of which face the same direction, two cones (with apexes at H and *II*) facing each other.

The general Aristotelian scheme of explaining the rainbow (with the exception of its geometrical details) is also seen in IBN SĪNĀ [HORTEN and WIEDEMANN, *Meteorologische Zeitschrift*, 30, 537 ff., 1913], QARĀFĪ [WIEDEMANN, *Archiv für die Geschichte der Naturwissenschaften und der Technik*, 4, 457 ff., 1913], and an anonymous work presented by WIEDEMANN on pp. 456, 457, loc. cit. The explanation of the shape of the bow by IBN AL HAITHAM is also similar, but contains certain important alterations of detail [E. WIEDEMANN, *Beiträge* 38, p. 45, 46]. THEODORICUS' way of accounting for the shape of the rainbow is likewise essen-

tially the same [J. WÜRDSMIDT, *Beiträge zur Geschichte der Philos. des Mittelalters* 12, H. 5-6, p. 21].

A criticism of ARISTOTLE's explanation of the shape of the rainbow in the light of the later knowledge of the laws of reflection could be made in the following manner : if the small mirrors represented by the water droplets are considered as three dimensional with smooth surfaces then the whole cloud would appear illuminated. If the small mirrors are considered as plane and their surfaces are considered to be coincident with the large spherical mirror (the cloud) then the shape of the rainbow could not be explained without violating the laws of reflection (remembering especially that the observer is at the center of the spherical surface). But laws of reflection are not known to ARISTOTLE in their correct form. All he knows is the existence of a geometrical uniformity. ARISTOTLE does not specifically mention the shape of the small mirrors (water droplets). We may assume that he considers them as acting as small plane surfaces. Under these conditions ARISTOTLE's explanation is perfectly legitimate. It is a geometrical scheme of approach, no doubt suggested by the geometrical uniformities already known to ARISTOTLE between the position of the bow, and the locations of the sun and the observer. The serious difficulty shows itself in explaining the secondary bow. The formation of a secondary bow would not be possible unless the uniformities, underlying processes of reflection as mentioned by ARISTOTLE, were violated.

VII.—THE LUNAR RAINBOW

ARISTOTLE speaks of the lunar rainbow, and says, " The rainbow is seen by day, and it was formerly thought that it never appeared by night as a moon rainbow. This opinion was due to the rarity of the occurrence : it was not observed, for though it does happen it does so rarely. The reason is that the colors are not so easy to see in the dark and that many other conditions must coincide, and all that in a single day in the month. For if there is to be one it must be at full moon, and then, as the moon is either rising or setting. So we have only met with two instances of a moon rainbow in more than fifty years." [Met. 372^a 20-30].

The moon rainbow looks quite white, [Met. 375[a] 17] and this is to be explained by the effect of color contrast. (See p. 69).

VIII.—Conclusion

There were two major problems involved in the explanation of the rainbow : the shape and the colors. The Aristotelian explanation of both these points is very good within the limitations to which he was subjected; in both cases, one may say, he went as far as it was possible.

Aristotle would not have been able to explain the shape of both the primary and the secondary rainbows without falling into serious inconsistency, without violating the uniformities underlying the reflection of light as he understood them. These uniformities, indispensable to him in explaining one of the bows, prevent him from being able to explain both. For the sake of accounting for the circular shape of the rainbow, Aristotle introduces certain simplifications such as the sun and the cloud being equally distant from the observer, and both at finite distances. Within these limitations and also, if one agrees to assume that Aristotle considered the raindrops as acting as small *plane* mirrors, the explanation of the shape is very good. This explanation was generally adopted by the medieval scholars who wrote on the rainbow, but their explanation is on a considerably lower level. The reason for this is that they adopted the general Aristotelian way, in spite of their correct knowledge of the laws of reflection. And the Aristotelian explanation of the shape of the bow is acceptable only with reference to the Aristotelian knowledge of the regularities of reflection. Ibn al Haitham, however, is an exception to this; he made the necessary alterations to fit the Aristotelian views with the laws of reflection (6). He reaches the limit of what could have been done on the subject without the introduction of refraction. The explanation of the appearance of colors by reflection from V, G, R (Fig. 1) contains a contradiction to the Aristotelian explanation of the shape of the bow, because it violates his laws of reflection. And one would not

(6) This statement would also be true in the case of Ibn Sīnā but only to a much smaller extent.

altogether be justified in accounting for this by the apparent diameter of the sun. However, slight contradictions of this sort could be overlooked. The disregard of the Euclidean laws of reflection, which were well established, is likewise seen in the Moslem writers on the rainbow. Even IBN AL HAITHAM is no exception to this, for the above objection raised in connection with Fig. 1 would apply to him equally.

All in all, considering the general level of scientific knowledge at the time, the Aristotelian explanation of the rainbow was a great contribution to scientific knowledge, and no real progress was made on the subject until the end of the thirteenth and the beginning of the fourteenth centuries.

IX.—APPENDIX : CHINESE LITERATURE ON THE RAINBOW (7)

In Chinese literature about the rainbow one meets classifications of the rainbow into such kinds as white, red, green, gray (of rarer occurrence), straight (of rarer occurrence), curved, male [hung^2 (5265)] (8) and female [i^2 (5434)] rainbows. Most of these classifications seem mainly to have served purposes of prognostication. Different rainbows would be omens of bad luck either in family or in political affairs, richness or poorness of harvest, rebellion, disloyalty to husband, etc.

As the quotations given below will show, the ancient Chinese conception of the formation of the rainbow may be summarized as follows :

1) The rainbow is some kind of a combination of yin^1 (13224) and yang^2 (12883), the universal male and female principles.

2) The rainbow is the result of a transformation of certain stars.

" The rainbow is the result of the attack of yang upon yin." [*Shih*^{4} *Ming*^{2} (9983, 7940), in *T'ai*^{4} *P'ing*^{2} *Yü*^{4} *Lan*^{3} (10573, 9310, 13645, 6735), vol. 14].

" The rainbow is the combination of yin and yang." [*I*^{4} *Ching*^{1} (5497, 2122), loc. cit.].

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(7) I thank Mr. SHIH-TSAI CH'EN of Harvard University for his help, without which this appendix would have been impossible.

(8) Chinese words are romanized according to H. A. GILES, *Chinese-English Dictionary*, 2nd edition, 1912, and the numbers refer to the numbers of the characters in that dictionary.

" The rainbow is the combination of yin and yang with forms and colors. If there is no cloud in the sky the male rainbow cannot be seen. If the sky is too dark it cannot be seen either. The female rainbow is often seen in cloudy sky. Both of them [male and female] can be seen in all seasons." [*Yüeh*[4] *Ling*[4] *Chang*[1] *Chü*[4] (13768, 7199, 390, 2947) by T'SAI[4] YUNG[1] (11519, 13477), loc. cit.].

" The rainbow is the spirit of yin and yang." [*Han*[4] *Shu*[1] (3836, 10024), loc. cit.].

" The Chên star breaks up to become a rainbow." [*Ho*[2] *T'u*[2] (3936, 12128), loc. cit.].

" The Ch'u star breaks up to become a rainbow." [*Ch'un*[1] *Ch'iu*[1] (2854, 2302), loc. cit.].

The following is a quotation from HSING PING (932-1010 A.D.), where the beginning of a scientific approach is seen : " The rainbow appears more frequently in spring. When a pair of rainbows appear simultaneously, the brighter one is the male rainbow, the fainter one is female. The male rainbow is the combination of yin and yang. If there is only yin or yang there will be no male rainbow. When the cloud is thin and when the solar rays reflect from the raindrops, then the male rainbow appears." Then, quoting from the book *Shuo*[1] *Wên*[2] (10164, 12633), he adds, " the female rainbow has a curved shape. The male rainbow is green and red, or white; it is yin." [*Commentary on Êrh*[3] *Ya*[3] *Chu*[4] *Su*[1] (3354, 12807, 2542, 10321), by HSING[2] PING[3] (4618, 9297), vol. 6].

(Harvard University) AYDIN M. SAYILI.

Euclide en chinois et mandchou

Ricci (1552-1610) désirait introduire en Chine les mathématiques et l'astronomie. Lié d'amitié avec de grands lettrés et de hauts dignitaires, il voulait montrer à ces fins humanistes la profondeur du raisonnement occidental et, du même coup, leur fournir la base des mathématiques et de l'astronomie. Malgré de graves difficultés provenant du style chinois et de la décadence des sciences, il eut, au milieu de ses multiples occupations, le courage d'entreprendre la traduction du géomètre grec.

Pour sa gloire, qu'il ne cherchait pas, ce fut un succès unique, dans ce pays où les mathématiques comptaient peu ou prou à côté des belles lettres.

Par suite des longues épreuves littéraires dans lesquelles ils devaient exceller, les premiers dignitaires étaient aussi les plus fins lettrés de l'Empire. Or, Ricci, à qui l'élégance des manières et le renom de savant avaient ouvert la capitale, sut habilement conquérir des amis et des protecteurs. Il réussit même à convertir Siu le célèbre ministre d'État (1562-1633) (1), fin lettré et grand patriote.

Au cours de ses entretiens, le missionnaire lui expliqua, proposition par proposition, les éléments d'Euclide. Saisi d'admiration pour la rigueur des démonstrations, Siu fit entendre que rien ne donnerait aux Chinois plus haute idée du génie des Occidentaux qu'une bonne traduction du géomètre grec. Ricci en convint; il connaissait bien le chinois mais Péking regorgeait de fins intellectuels, très exigeants : il lui fallait donc un aide de première valeur.

Parmi les amis de Siu, se trouvait un excellent licencié, pauvre mais plein de talent. Des honoraires convenables l'attachèrent au jésuite italien : le missionnaire expliquerait le texte que le lettré chinois mettrait en style chinois châtié. L'essai fut malheureux

(1) Le troisième centenaire de sa mort a été célébré en 1933 (*Isis* 24, 122-3).

et RICCI dut avouer son échec. Tous les lettrés, insinua-t-il à SIU, n'avaient pas la perspicacité d'un ministre. SIU comprit et pendant plus d'un an, il vint chaque jour, parfois pendant plusieurs heures, se faire expliquer EUCLIDE.

A Rome, RICCI avait eu CLAVIUS pour maître; à Péking, l'édition CLAVIUS, texte et notes, eut les honneurs de la traduction (1).

(1) *Texte dans* : Christofori Clavii Bambergensis e Societate Jesu Opera Mathematica. Moguntiae. Sumptibus Antonii Hierat. Excudebat Reinhaldus Eltz. Anno MDCXII. — Sous cet illustre maître, RICCI étudia l'arithmétique, les Éléments d'EUCLIDE et probablement les Sphériques de THÉODOSE, la Sphère de SACRO BOSCO, et l'Almageste de PTOLÉMÉE. Maintefois, dans sa correspondance, il déplore son manque de livres. Aussi comme il remercie son vieux maître de lui

RICCI expliquait d'abord le texte et les figures. Quand son intelligent élève avait bien saisi, il lui dictait la traduction, puis le ministre se retirait pour polir à loisir son style. RICCI revoyait le tout, indiquait les endroits à corriger ou à perfectionner, et SIU apportait les transformations nécessaires. Par trois fois le ministre refit sa traduction ! Pour la partie matérielle, ils avaient des copistes, eux-mêmes lettrés, et des correcteurs, eux-mêmes stylistes. SIU voulait un livre chinois.

De cette collaboration est sorti l'ouvrage universellement connu en Chine, sous le nom de *Ki-ho Yuan-pen*. *Ki-ho*, littéralement : " combien, quantité, grandeur." Actuellement encore, malgré le fatras des nouveaux termes introduits, à tort et à travers, géométrie se dit : *Ki-ho hio*. (hio : science). Par *Yuan-pen*, il faut entendre " volume original ", " premier texte " où *yuan* signifie origine et *pen* volume.

De l'avis unanime des lettrés, le style est excellent. La phrase coule sans embarras. C'est du chinois qu'on lit, et non pas de l'européen mal ficelé dans des vêtements d'emprunt, comme c'est trop souvent le cas pour les ouvrages modernes jetés hâtivement sur le marché.

Le succès de la traduction RICCI-SIU fut prodigieux. Tout était neuf pour la Chine : profondeur de la doctrine, enchaînement des idées, élégance du style. La plupart des lettrés, laissés à leurs propres moyens, ne comprenaient pas. Pour voir clair dans EUCLIDE, ils devaient se le faire expliquer; mais alors leur étonnement redoublait. Jamais ils n'avaient soupçonné que des vérités pouvaient se déduire les unes des autres avec tant de logique. RICCI, et parfois SIU lui-même, s'improvisaient professeurs avec la meilleure grâce. Le missionnaire s'acquérait ainsi une grande autorité.

Les six livres chinois d'EUCLIDE sont en effet un modèle de l'art difficile de faire passer dans la langue chinoise un ouvrage européen. Outre le texte, la version donne commentaires et scolies importants

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avoir envoyé l'Astrolabe ! Le cours d'algèbre au collège Romain ne dépassait pas l'Ars Magna de CARDAN et l'Arithmetica Integra de STIFEL. CLAVIUS, dans son Algèbre, adopta les notations et les méthodes de STIFEL, sans citer la source. STIFEL était un protestant combatif; en reconnaissant son mérite, CLAVIUS eût cru donner un gage à la Réforme.

de CLAVIUS (1). Dans les deux préfaces, composées par le ministre, le missionnaire faisait d'abord, dans le goût chinois, l'éloge d'EUCLIDE et de CLAVIUS; puis, SIU, parlant en son nom personnel, exaltait la science européenne.

L'édition originale est de Péking, 1607. RICCI envoya à plusieurs reprises les volumes chinois en Europe (2).

Le traducteur, conscient de l'impression produite, notait toutefois avec une pointe de malice : " L'ouvrage fut plus admiré que compris." (3)

RICCI préparait une édition corrigée. Une note de PAUL SIU mise dans l'édition posthume de 1615, donne des détails intéressants sur ce projet.

RICCI, de son vivant, avait donné son œuvre corrigée à un ami qui n'en fit rien. A la mort de RICCI, les PP. PANTOJA et DE URSIS trouvèrent un exemplaire corrigé de sa main; mais, à l'été de 1611, un violent orage et de grandes pluies dispersèrent les papiers du défunt. Les deux Pères et PAUL SIU, auteurs de la seconde édition corrigée, durent s'en contenter à leur grand chagrin.

Malheureusement la traduction s'arrête après le sixième livre.

WYLIE (1815-1881), fin connaisseur et bon sinologue, estima que le meilleur service à rendre à la Chine qui pense, serait d'achever ce travail. Aidé par le mathématicien KI CHAN-LAN (1814-1884), il traduisit de l'anglais les sept livres restants, ainsi que les deux livres supplémentaires de CLAVIUS. Les traducteurs sont, il est vrai, moins illustres, mais leur travail est fait avec grand soin. Le très célèbre vice-roi TSENG KOUO-FAN s'est honoré en publiant la première édition complète d'EUCLIDE, à Wou-tchang, en 1865.

Éditions :

1607. *Édition princeps*, xylographiée; plusieurs tirages à la chinoise. Préfaces de RICCI et de SIU.

(1) CLAVIUS, traduction latine de SCHLÜSSEL, fut traduit en chinois par TING (= Clou). L'édition chinoise comprend donc les XIII livres d'EUCLIDE et les II livres supplémentaires de CLAVIUS.

(2) « Je ne vous fais pas parvenir la traduction complète de tout l'ouvrage, écrit-il à AQUAVIVA, le 28 août 1608. Ceux qui connaissent EUCLIDE devineront suffisamment, par les figures, quel sujet est traité dans chaque page. » Des deux préfaces il ajoutait la version latine. Voir facsimile de la page de titre de l'édition de 1607 et portrait de RICCI dans *Isis* 26, 165-6.

(3) RICCI, Opere I, p. 502.

1615. Édition posthume par SIU (PANTOJA et DE URSIS); préface de SIU expliquant la perte de l'exemplaire corrigé par RICCI,
1629. Réimpression dans la collection *T'ien-hio tch'ou-han*, par LI TCHE-TSAO.
1721. Réimpression dans le *Chou tou yen* de FANG TCHONG-T'ONG.
1723. Édition impériale *Yong-tcheng*.
1860. Réimpression très fautive, à Canton, par le marchand PIEN TIN-KOU.
1862. WYLIE-LI, xylographié à Song kiang, par HAN LIU-K'ING; planches détruites par les *Rebelles aux Longs Cheveux*.
1865. Euclide-Clavius imprimé à Wou-tch'ang, aux frais du vice-roi TSENG KOUO-FAN.
1887. Édition de *Wou-tch'ang*, à Changhai, petit format 16 × 9.
1889. Édition de *Wou-tch'ang* lithographiée dans le *Thesaurus mathématique* de TCH'EN WEI-KI.

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VERBIEST, professeur de l'empereur K'ANG-HI, mit en Mandchou les six premiers livres d'EUCLIDE, d'après le chinois. Plus tard BOUVET et GERBILLON expliquèrent également la géométrie à K'ANG-HI. BOUVET (*Portrait historique de l'Empereur de la Chine*, p. 129), parlant des *Éléments*, écrit : " Nous les avons composés en tartare." Ces traductions sont restées manuscrites.

L. VANHEE.

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Twentieth annual report for the period extending from July 1, 1937 to June 30, 1938 (Previous reports appeared in *Year Books* of the Carnegie Institution, no. 18 to 36, 1919 to 1938; the 12th and following also appeared in *Isis*, the latest in vol. 28, 87-91.)

I. *Introduction to the History of Science.*—Notable progress has been made in the preparation of volume III, dealing with the fourteenth century, 152 articles, some of them of considerable length, having been written. Though the redaction of these articles is now meant to be final, it is likely—judging from my earlier experiences—that before the work is completed, many of them will require additions and revisions, and that a few may have to be entirely rewritten. All of these notes concern the authors of scientific texts in Latin or in the vernaculars of western Europe. Dr. WELBORN has continued to help me throughout the year, checking data and adding items to the bibliographies.

The end of the Latin and western European part (by far the largest of the book) is now in sight, and it is hoped to complete the analytic stage of the whole work within the next academic year. This very elaborate and patient analysis is nothing but a preparation for the synthesis of fourteenth century science and learning which will then be undertaken.

II. *Maya Astronomy.* (1)—It becomes increasingly difficult, on account of the very technical subject matter of these yearly reports, to make them concise, yet intelligible both to Mayologists and to astronomers. No technical explanations will be given in the present report. Work on the various aspects of the correlation problem proceeded slowly, the two principal investigations being

(1) This chapter is contributed by Dr. A. POGO.

centered on the lunar and on the planetary records of the Maya. A considerable amount of time was devoted to the reading of the proofs of Dr. MORLEY's forthcoming Inscriptions of the Petén; all the Maya dates and calendarial computations found in the work were checked. The appended bibliography indicates the progress of the theoretical investigations dealing with eclipses in general, and of the accumulation of observational data on the visibility of penumbral lunar eclipses in particular; these studies, necessary for a deeper insight into the structure of the Maya records preserved in the Dresden Codex, have yielded results which ought to be of interest to students of Mesopotamian-Mediterranean eclipse records.

III. *Scientific incunabula.*—The publication of ARNOLD C. KLEBS' "Incunabula scientifica et medica" (*Osiris*, vol. IV, p. 1-360, 1937), a work which had been on the stocks for a great many years, made it possible to undertake a study which I had been thinking of for a long time but which I had deliberately postponed until KLEBS' preliminary survey became available. As I have frequently explained it, it does not suffice to state when, where and how a discovery has been made or a scientific treatise written; it is equally necessary to set forth the *tradition* of that discovery or of that treatise, for if the discovery or the treatise had not been transmitted it is almost the same as if the former had never been made, or as if the latter had never been composed. In the history of scientific tradition it is always important to find out exactly when it first occurred in print, for in most cases the printing of a text meant its final salvation for posterity. Thus in volumes I and II of my *Introduction* I have taken special pains to indicate the earliest printed editions of each text dealt with. These earliest editions are often incunabula, i.e., prints anterior to 1501, and the historian of science, even if he is not especially interested in rare books because of their rarity, is nevertheless obliged to pay special attention to those incunabula.

Though my earliest investigations had led me to the examination of many incunabula problems, I had never taken the trouble of surveying the incunabula literature in general. Dr. KLEBS' careful list of all the scientific and medical incunabula made it possible for the first time to consider scientific incunabula as a

group, from the statistical point of view. The results of my investigations will appear in *Osiris* (vol. V). It is hoped that the incunabula studies of Dr. KLEBS and mine will encourage other students to prepare careful analyses and discussions of the ***contents*** of incunabula. Thus far these precious volumes have been treated too much like relics and considered from the outside only, from the rather low point of view of the collector who cares for bibliographical rarities rather than for ideas, and treasures his books but does not read them.

IV. *Institute for the History of Science.*—I have published (in *Isis* 28, 7-17, 1938) a third explanation of the need of such an Institute and have outlined the principles of its organization. It should be noted that the rooms occupied by this section of the Carnegie Institution in the Widener Library of Harvard University (rooms 185, 189) constitute already, in a very modest way, such an institute. Many of the so-called institutes attached to European universities are far more rudimentary. A brief account of the facilities already available will not be out of place.

According to a census made in December 1937, these rooms contain 3,130 books, 8,060 pamphlets (reprints, etc.), and some 40,000 bibliographical cards.

The books and pamphlets are of three kinds with regard to provenance. Some were bought by me, others were given to the Editor of *Isis*, finally 823 were bought by the Carnegie Institution. Of these 823, 1 was bought in 1918, and 822 others within the period 1930-37. The largest group is naturally the second, that is, the books and pamphlets presented to the Editor of *Isis*, though it represents only a part of the total number given to him, as many of these books are surrendered to other scholars who kindly undertake to review them.

In its totality this apparatus criticus is probably the richest of its kind anywhere, but its potential value is enormously increased by the fact that the rooms housing it are only a part of the Harvard University Library or Widener Library, the largest university library in the world to-day. The total number of the books and pamphlets in that library (and departmental libraries connected with it) is approaching four million. These books are completely and almost immediately available to the students using

our apparatus. For example, the Harvard University Library has full sets of almost all the important scientific and learned periodicals and of the academic serials published anywhere in the world. Thanks to the generous coöperation of Harvard University and of the Carnegie Institution an instrument has been created which is already very good, and might be excellent if the space available for books, archives, and students were increased, and means provided for its development and for a better utilization of it.

The rooms are always occupied by Dr. SARTON, Dr. WELBORN, and FRANCES SIEGEL (secretary of the section) and are often occupied by two or three other persons, students or scholars. They are used for the seminary in the history of science and learning in Harvard University, and are becoming more and more extensively recognized as a center of information for these studies. All the qualities of an institute are thus brought together, except stability and permanence.

Many members of the faculty and students, not only of Harvard University but of other colleges, as well as visiting scholars, come to consult our archives and are generally welcome. In addition, many inquiries are received by mail, and efforts are made to satisfy them as much as possible.

That is all right, but one cannot eat one's cake and have it; my energy is not unlimited; my own work cannot but be delayed and suffer otherwise from these constant interruptions. In short the burden falling on my shoulders is too great; such a heavy burden jeopardizes my work and self and may end in destroying us both.

V. *Editing of Isis and Osiris.*—The " institutional ", or pedagogical and normal function of this section of the Carnegie Institution appears very clearly in its editorial activities, for the journal *Isis* centralizes information concerning the history of science received from everywhere, classifies it, submits it to criticism and redistributes it to whomever it may concern anywhere in the world.

During the course of last year four numbers of *Isis* were published (74 to 77) completing vol. 27 and 28, plus volumes 3 and 4 of *Osiris*, devoted to the longer memoirs. A total of 2318

pages, illustrated with 17 plates, 119 figures, containing 59 memoirs, 33 shorter notes, 96 reviews and 1655 bibliographical items.

It is worthwhile noting that every memoir published in *Osiris* is the subject of a separate card printed by the Library of Congress. The same could not be done of course for *Isis*, the contents of which are far too abundant.

VI. *Lectures.*—Dr. SARTON gave a course of 33 lectures on the history of mathematics, from the origins down to the nineteenth century, at Harvard University and also at Radcliffe College. In addition he lectured on " Scientific incunabula " at the Indianapolis meeting of the American Association for the Advancement of Science (Dec. 30) and also before the Harvard Medical School; on " The study of ancient science " before the Phi Beta Kappa chapter of Radcliffe College (March 23), and on " The oriental origins of western science " before the Philadelphia meeting of the American Oriental Society (April 20).

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Notes and Correspondence

The Editor of *Isis* is always glad to publish notes relative to the teaching of the History of Science, the activities of societies devoted to our studies, or commemorations, provided that these notes be sufficiently brief and carefully written and do not require too much editing.

Easter 1938.

Query no. 79.—A seventeenth century artificial representation of the four elements.—CRELL's *Chemisches Archiv*, I., p. 151, (1783) gives an abstract of a paper by HIERONYMUS AMBROSIUS LANGENMANTEL (1641-1718) which had originally appeared in *Abhandlg. d. Akad. d. Naturforscher*, XVII., p. 439, (1689), and which reads as follows : " Man nimmt (1) Steinöl (*oleum petrae*), das man mit gelben Brasilienholz gefärbt hat; (2) rectificierten Weingeist mit rothem Sandelholz gefärbt; zum dritten verdünntes Weinsteinöl, das mit destillirtem Grünspan vermischt ist; und endlich Kleine gestossene Granatsteine." I should like to know what to make of this.

(*Bristol.*) M. NIERENSTEIN.

Query no. 80.—When was logarithmic paper first used? Who introduced it?

(*Philadelphia Electric Company*) LEWIS B. BEATTY.

I tried to answer this query and was able to send to Mr. BEATTY the following incomplete answer which is perhaps worth reproducing and may elicit further information.

The question you are interested in, history of log paper, does not really concern the history of mathematics. No new principle is involved, it is simply a matter of convenience. Hence it is not surprising that even the most elaborate histories of mathematics, as CANTOR's *Vorlesungen* and TROPFKE's *Geschichte der Elementar-Mathematik*, do not refer to it. The two following extracts may serve your purpose, or at least put you on the track of a more complete answer.

" *The logarithmic grid and ratio chart.*—Logarithmic grids were first drawn by LÉON LALANNE in 1843 as the simplest and most widely applic-

able example of the principle of the transformation of scales to which he gave the name anamorphic geometry. By means of the theory outlined by LALANNE, mathematicians and engineers have since translated various curves representing technological formulas into simpler curves or straight lines. The type of grid which has the ordinary equally-spaced ruling for one axis, usually the horizontal, and a logarithmic ruling for the other is called a semi-logarithmic grid or ratio chart. JEVONS in 1863 made use of such a grid to show the relative or percentage rise and fall of commodities. He drew no curves but indicated each commodity by a dot. "

(H. G. FUNKHOUSER : Historical development of the graphical representation of statistical data, *Osiris* 3, p. 359, 1937).

An inquiry to KEUFFEL and ESSER Co., makers of log paper, Hoboken, N. J., elicited the following answer :

" Reference is made to your letter of June 29th, relative to the originator of logarithmic paper. It would probably require considerable research to develop this fact, since it is quite possible that someone conceived the idea of logarithmic paper about the time GUNTER invented the logarithmic scale in 1620. However, the earliest reference to logarithmic paper that we know about, is an article in the *Engineering News* of Sept. 28, 1893, entitled—' The uses of logarithmic cross-section paper '—by W. F. DURAND, M. Am. Soc. M. E., principal of graduate school of marine engineering and naval architecture, Sibley College, Cornell University. It first appeared in our catalog of 1897, under the heading—' DURAND's logarithmic paper.' The illustration was shown. So far as we know that was the first listing of logarithmic paper in this country. While we carry many logarithmic papers, we still list our W336 as ' DURAND's logarithmic paper'."

GEORGE SARTON.

Purdue University (Lafayette, Indiana).—A course in the historical and social sides of technology, entitled Social Aspects of Technology, was given in Purdue University the 2d semester of the past year, 3 hrs., by Dr. S. C. GILFILLAN, Asst. Prof. of Sociology, who has specialized in these fields. The 15 students were all men, almost all engineering students, and mostly Seniors. The course had been intended as well for upper-class students of Sociology, Economics and History; its appealing only to Engineers however is not surprising in view of the distribution of students generally at Purdue, which is the practical-minded, technological half of the state's university.

The first half of the course was given to the history of invention, by topical fields, with special emphasis on transportation, incl. the ship

with which the professor was most familiar, and LEFEBVRE DES NOËTTES' notable discovery of the ruinous stupidity of the *harness* universal till around 1000 A.D. The first month carried each topic to the Industrial Revolution, and the second to the present. The final 2 months were given to the social causes, results and prediction of invention, using the professor's *Sociology of Invention* and pamphlets by OGBURN and others as texts. For the historical portion no suitable textbook was found, so library readings, and loans of the professor's *Inventing the Ship* were tried; but it would have been better to adopt I. B. HART's *Great Engineers* or some other book as text. All students questioned at the end of the course valued the modern social science part more than the historical. Term papers were called for, with widest choice of topics, and students commonly chose, as hoped, the history of an invention or industry they were looking forward to professionally. The professor often met students in the valuable Goss Library of Engineering History, containing 2000 volumes.

S. C. GILFILLAN.

Winthrop Society.—A society for the study of the History of Science was formed on May 25, 1938 at Cambridge, Massachusetts. It plans to hold monthly meetings at which papers on the History of Science will be presented. The membership fee is one dollar per annum. Anyone interested will please communicate with the Corresponding Secretary of the Winthrop Society,

134 Mt. Auburn Street,
Cambridge, Mass.

ALBERT R. GOLDSMITH,
Corresponding Secretary.

The Unity Schools, under the direction of F. S. Marvin.—The Fifteenth Unity School was held at Jordans (1) from the 20th to the 23rd May 1938, and had the special interest of being a return to the spot where the idea was first mooted, twenty-four years before on the day of the outbreak of the Great War. Again on this occasion the international horizon was heavily overcast, but the proceedings at the school itself were of the most delightful harmonious and enlightening kind. There has never been at any one of these gatherings, so free and useful an exchange

(1) Jordans is the oldest settlement of the Quakers in England. It is between Beaconsfield (21 1/2 m. from London) and Chalfont St. Giles, where MILTON lived in 1665-1666. In the burial ground of Jordans lie WILLIAM PENN, his two wives and five of his children, THOMAS ELLWOOD, MILTON's friend, and other prominent Quakers. The meeting house was built in 1688. Jordans is now beautifully arranged as a quiet retreat for Friends and is a favorite resort for peaceful men and women, often selected for small conferences. G. S.

of views, and the present surroundings and arrangements at Jordans Hostel are perfect for the purpose.

The general subject was the need and the relation of Philosophy to the Social Sciences and an introductory address on that topic was given by Prof. MORRIS GINSBERG, on the evening of the 20th. It was at once taken up by Prof. FIELD, and others. On the morning of the 21st Mr. F. S. MARVIN introduced the central subject of "What we mean by Social Justice," and the liveliness of the discussion showed clearly how deeply the current thinking on these questions goes, and how much it needs clarification and as far as possible harmonization. On the evening of the 21st, Prof. C. H. DESCH introduced the question of the comparison of our approach to truth in physical and social science. Prof. HERBERT DINGLE gave a parallel statement and again the discussion was of the most general and lively kind. In particular the question was raised, and viewed from several angles, of whether it is possible in social science properly to speak of a scientific experiment. On Sunday morning, the 22nd, Prof. J. H. MUIRHEAD gave a carefully prepared and moving discourse on the place of the State in relation to right and justice, with the title, "State Law and Individual Morality." This as it obviously touched questions of the gravest international moment, was as fully debated as either of the other topics. The programme, as originally drawn up, was concluded on the Sunday evening by a historical review by Dr. A. J. CARLYLE of the various larger subjects which had occurred in the earlier debates—Justice, Law, Sovereignty and the freedom and equality of men—mainly as they are treated in the codes and writings of Greeks, Roman jurists and mediaeval thinkers. This large sweep was brilliantly accomplished and naturally partook rather more of a full lecture than a discussion by the body of the audience.

It should be added that as the party had the advantage of the presence, both of Mrs. BEER, lately from Vienna, and of Dr. SALAMAN, from his researches into the viruses of plants, opportunity was made for both of them to give some account of their experiences and both were much appreciated.

In view of the great success and obvious usefulness of such gatherings, it must occur to every one who has enjoyed them, whether it would not be feasible to extend their benefits to a larger number of people, more frequent occasions and a still wider expanse of subjects. To induce the philosophic spirit of sifting our thoughts and statements and if possible, of harmonizing them, is one of the greatest services which could be offered to contemporary civilization. These gatherings have always shown that it is possible to make large headway in this direction with a maximum of social pleasure and goodwill among the participants.

Those who have had such an experience of a Unity School are earnestly requested to think out the question and make any suggestions which may occur to them :

Could such gatherings be multiplied ?

Can they be brought to the knowledge of a larger circle of similarly interested people ?

Are occasional foreign visits e.g. to such neighbouring countries as France, Belgium or Holland, worth the extra considerable labour of organisation ?

What are the best subjects or groups of subjects to be approached ?

Who will give some personal service in the way either of propaganda or of organisation ?

Communications either to F. S. MARVIN,
Pantiles,
Coneydale,
Welwyn Garden City, Herts.
or to Mrs. INNES,
Portway,
St. Mary Bourne,
Andover, Hants.

Personalia.—(News pertinent to this section should be sent directly to Mr. L. GUINET, 11 place Général Meiser, Brussels, Belgium).

Dr. GEORGE SARTON was elected a Fellow of the Mediaeval Academy of America at the annual meeting held in Chicago on April 29, 1938. The citation made by the orator, professor E. K. RAND, follows :

" GEORGIUS SARTON, civis olim Belgicus nunc Americanus, Universitatis Gandavensis alumnus, Litterarum Humaniorum Doctor Brunensis, Legum Doctor Harvardianus, in Universitate Harvardiana Scientiarum Annalium Praelector, Instituti Carnegiani Washingtoniensis Adsocius, validus Arabum defensor, Isidis et Osiridis venerabilis antistes, qui omnia quae omnibus aetatibus viri litteratiores de rerum natura cultuque humano scripserint, cogitaverint, somniaverint, uno velut intuitu perspicit et iudicat."

Reviews

Léon Gauthier.—*Hayy ben Yaqdhân, roman philosophique d'*Ibn Thofaïl. Texte arabe, avec les variantes des manuscrits et de plusieurs editions, et traduction française. 2e édition, revue, augmentée et complètement remaniée par Léon Gauthier. xxxiv+193 p.; 188 p. in Arabic. (Institut d'études orientales de la Faculté des lettres d'Alger, 3). Beyrouth, Imprimerie Catholique, 1936 (La date de publication n'est vraie que pour l'introduction; la publication n'a été complétée qu'en 1937, ou avant avril 1938).

J'avais déjà eu l'occasion dans mon *Introduction* (vol. 2, 355, 1931) de rendre hommage aux travaux de M. Léon Gauthier (professeur de l'histoire de la philosophie musulmane à la Faculté des lettres d'Alger) sur Ibn Ṭufail. Il avait consacré à cette étrange figure andalousienne une étude fondamentale (Alger 1909), et on lui devait la meilleure édition du texte arabe, augmentée d'une traduction française (260 p., Alger 1900). De plus j'avais signalé *(ibidem*, p. 400) l'importance de son étude sur l'astronomie arabe de cette époque. Je suis heureux de pouvoir annoncer à nos lecteurs la publication d'une nouvelle édition augmentée et remaniée, dans laquelle il a pu tenir compte des travaux d'Emilio García Gómez et d'autres. Ces travaux récents, à vrai dire, n'ont rien ajouté de vraiment essentiel, mais ils ont enrichi notre connaissance des traditions littéraires qui ont abouti à la *Risālat Ḥaiy bin Yaqẓân fi asrâr alḥikmat al-mushraqiyyat*, l'un des livres les plus originaux du Moyen âge. D'autre part le texte et la traduction ont été améliorés. L'auteur nous dit (p. iii) :

" La possibilité, qui s'offrait à nous maintenant, de dépouiller, soit directement, soit d'après une copie photographique, trois nouveaux manuscrits, sans parler d'une troisième édition égyptienne, a eu pour conséquence un accroissement considérable de notre liste des variantes, et parfois une refonte du texte. L'adoption d'un certain nombre de leçons meilleures et, d'autre part, une révision minutieuse de notre version française de 1900, révision plusieurs fois répétée dans nos conférences d'explication de textes philosophiques arabes à la Faculté des lettres d'Alger, nous ont permis d'améliorer sensiblement notre primitive traduction."

Cette édition modèle est accompagnée de tous les index désirables, d'un glossaire arabe, d'une introduction qui nous offre une biographie sommaire d'Ibn Ṭufail, une étude sur son unique ouvrage philosophique

et ses sources, les manuscrits, les éditions antérieures, et les traductions hébraïque, latine, anglaises, hollandaise, allemandes, française, espagnoles, et russe. On voit que le livre d'Ibn Ṭufail appartient à la littérature universelle. La première édition est celle du grand orientaliste anglais

PHILOSOPHUS AUTODIDACTUS
SIVE
EPISTOLA
ABI JAAFAR,
EBN TOPHAIL
DE
HAI EBN YOKDHAN.
IN QUA
Oftenditur, quomodo ex Inferiorum contemplatione ad Superiorum notitiam Ratio humana aſcendere poſſit.

Ex Arabicâ in Linguam Latinam verſa
Ab EDVARDO POCOCKIO.

Editio ſecunda priori emendatior.

OXONII,
E THEATRO SHELDONIANO. *A.D.* 1700.
Excudebat Joannes Owens

Edward Pococke sr. (1604-91), à laquelle fut ajoutée une traduction latine par son fils Edward Pococke, jr. (1648-1727). Cette édition arabe-latine parut à Oxford en 1671, et fut réimprimée en 1700 (1).

(1) Je publie des facsimilés de la page de titre et de la première page du texte arabe de la deuxième édition. La première ligne du titre mesure 93 mm. En dépit du sous-titre *Editio secunda priori emendatior*, cette édition ne paraît différer

La première édition orientale ne fut publiée qu'après un délai de plus de deux siècles (Le Caire 1882); elle a été suivie de plusieurs autres. La première édition scientifique fut celle du Professeur GAUTHIER (Alger 1900), qui dans sa forme nouvelle (Beyrouth 1938) paraît être définitive.

De Hai Ebn Yokdhan. 2

بسم الله الرحمن الرحيم

الشيخ الفقيه الامام العالم الفاضل الكامل العارف ابو جعفر بن طفيل رحمه الله عليه

الحمد لله العظيم الاعظم القديم الاقدم العليم الاعلم الحكيم الاحكم الرحيم الرحمن الكريم الاكرم الحليم الاحلم الذي علم بالقلم علم الانسان ما لم يعلم وكان الفضل الله عليه عظيما احمده على فواضل النعما واشكره على تقادم الآلاء واشهد الا اله الا الله وحده لا شريك له وان محمدا عبده ورسوله صاحب الخلق الطاهر والمعجز الباهر والبرهان القاهر والسيف الشاهر صلوات الله عليه وسلامه وعلى آله وصحبه اولي الهمم العظام وذوي المناقب والمعالم وعلى جميع الصحابة والتابعين الى يوم الدين وسلم كثيرا سألت ايها الاخ الكريم الصفي الحميم منحك الله البقا الابدي واسعدك السعد السرمدي ان ابث اليك ما امكنني بثه من اسرار الحكمة المشرقية التي ذكرها الشيخ الامام الرئيس ابو علي بن سينا واعلم ان من اراد الحق الذي لا جمجمة فيه فعليه بطلبها والجد في اقتنابها ولقد حرك مني سوالك خاطرا شريفا افضي بي والحمد لله الى مشاهدة حال لم اشهدها

L'auteur a ajouté des appendices intéressants, par exemple, l'App. II où l'œuvre d'IBN ṬUFAIL est comparée aux traités des Frères de la sincérité, composés à al-Baṣra vers la fin du X^e siècle et qui furent connus assez vite en Occident (voir mon *Introd.*, 1, 660-61, 668). Il conclut (p. 120) :

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aucunement de la première; elle contient la même table d'errata ! Soit dit en passant, les premières impressions arabes d'Oxford datent de 1648.

" Nous n'avons pu découvrir, malgré quelques rares et vagues analogies de détail, aucune raison valable d'attribuer à l'Encyclopédie des Frères de la Sincérité une influence, avouée ou inavouée, directe ou indirecte, sur les doctrines, ou même sur certains détails épars du *Hayy ben Yaqdhân*. Nous doutons qu'un dépouillement plus complet, une étude plus approfondie des quatre volumes compacts de cette Encyclopédie, puisse modifier essentiellement cette conclusion générale."

L'appendice III étudie les rapports entre IBN ṬUFAIL et IBN RUSHD qui étaient contemporains et se connaissaient, mais ne se citèrent pas.

" Aucun de ces deux grands esprits ne devait se croire fondé à citer l'autre à titre d'autorité philosophique. Et après tout, en s'abstenant de citer IBN THOFAÏL philosophe, dont il se serait cru obligé de relever, à chaque pas, les ' erreurs ' de doctrine et les fautes de méthode, comme il le fait si vertement à l'encontre d'EL-GHAZÂLÎ, d'IBN SINÂ et d'autres falâcifa, en ne le nommant qu'à propos de questions d'ordre scientifique, étrangères à la philosophie, peut-être IBN ROCHD a-t-il voulu, à sa façon, donner à son protecteur une marque muette de sa reconnaissance." (p. 128).

L'appendice IV intéressera surtout les étudiants de l'anatomie médiévale, — c'est une discussion de *l'os stomachi* d'IBN RUSHD, expression qui a deux sens (2) bien distincts.

Les deux derniers appendices sont consacrés (V) aux qualités premières des quatre éléments, et (VI) aux rapports de la religion et de la philosophie chez IBN ṬUFAIL, et accessoirement sur le mouvement de la Terre chez les Musulmans. Ces titres rappelleront au lecteur que le *Ḥaiy bin Yaqẓân* est un document précieux pour l'étude de la diffusion des idées scientifiques au XII[e] siècle.

Ce livre fait le plus grand honneur non seulement à l'auteur mais aussi à la Faculté des lettres d'Alger. GEORGE SARTON.

A. C. Moule and **Paul Pelliot.**—*Marco Polo: The description of the world.* Vol. II. London: GEORGE ROUTLEDGE and Sons, Ltd., 1938. (To consist of four volumes, demy 4to, 1300 pages, 80 plates. Sold only in complete sets at six guineas net. Edition limited to 450 sets. The acceptance of Volume II, which is published first, binds the purchaser to accept the other three volumes when published.)

In 1871 Sir HENRY YULE published his monumental edition of the *Travels of* MARCO POLO. In the following year the President of the Società Geografica Italiana observed that the field of POLO studies might now be regarded as closed. He added with some regret that this feat

(2) Ces deux sens avaient déjà été indiqués par A. FONAHN, dans son ouvrage *Arabic and Latin anatomical terminology* (p. 111, Kristiania, 1922; *Isis* 5, 170-2) que l'auteur, si bien renseigné, paraît ne pas connaître.

had been accomplished not by an Italian but by an Englishman. The statement was unfortunate. It obscured the fact that, despite its merits, the Yule edition had not really exhausted any of the three basic POLO problems—the establishment of a completely satisfactory text, the interpretation of the account, and the reconstruction of POLO's biography. It may further have contributed to the causes of the relative stagnation in POLO scholarship which set in for more than 50 years.

Apart from the re-edition of YULE with supplementary notes by HENRI CORDIER (1903), little was accomplished in this field until 1928. In that year Professor LUIGI FOSCOLO BENEDETTO published what he called the " prima edizione integrale " under the title *Il Milione* (1). With BENEDETTO's edition the honors in POLO scholarship clearly returned to Italy.

The importance of *Il Milione* lies not merely in the publication of an integral text, but in the establishment on a critical basis of the entire problem, what did MARCO POLO actually write? BENEDETTO pointed out, however, that his own work was not to be regarded as final, but rather as a preliminary to new and more advanced studies of the great Venetian traveller. In particular he expressed the hope that " qualche romanista di gusto " might utilize the material which he had provided as a basis for an authentic translation of the *Milione*. In 1932 BENEDETTO himself fulfilled this hope, preparing an Italian translation based upon a comprehensive text (2). BENEDETTO's text, in turn served for an English translation by ALDO RICCI (3). Another product of this renewed interest in MARCO POLO was the publication of a reprint from the Elizabethan translation of JOHN FRAMPTON, edited by N. M. PENZER (4). None of these works, however, can be said to have advanced POLO scholarship beyond the stage upon which BENEDETTO had placed it in

(1) MARCO POLO, *Il Milione*, prima edizione integrale a cura di LUIGI FOSCOLO BENEDETTO, sotto il patronato della città di Venezia. Florence; OLSCHKI, 1928. (Comitato Geografico Nazionale Italiano, Pubblicazione N. 3).

(2) MARCO POLO. Il libro di Messer MARCO POLO cittadino di Venezia detto Milione, dove si raccontano le Meraviglie del Mondo. Ricostruito criticamente e per la prima volta integralmente tradotto in lingua italiana da L. F. B. Milan: TREVES-TRECCANI-TUMMINELLI, 1932.

(3) *The travels of Marco Polo*, translated into English from the text of L. F. BENEDETTO by Prof. ALDO RICCI, with an introduction and index by Sir E. DENISON ROSS. London: G. ROUTLEDGE & Sons, 1931.

(4) *The most noble and famous travels of Marco Polo, together with the travels of Nicolò de' Conti*, edited from the Elizabethan translation of JOHN FRAMPTON with introduction, notes and appendixes by N. M. PENZER, M. A. London: Argonaut Press, 1929.—PENZER's introduction contains a good summary of BENEDETTO's findings. It may be supplemented by his reviews in *The Asiatic Review*, Oct. 1928, Jan. 1929 and April 1929.

1928 (5). That task, if it can be accomplished, may well be the merit of the work which is now under review.

It is impossible, of course, with only one of the four prospective volumes actually published, to determine whether this work will recapture the honors in POLO scholarship from Italy. We may, however, form some impression from the publisher's announcement of what the other volumes will contain. Volume I (ca. 580 pages) will present an authoritative English translation based upon the most complete critical variorum text now available. It will be preceded by an introduction covering the history and bibliography of the POLO text, and incorporating the results of new research on the genealogy of MARCO POLO, the extent of his wealth and other related topics. In addition the volume will include a *Table of Chapter Numbers* from other editions, a classified list of the 143 known MSS., and a transcription of 52 *Documents* relating to the POLO family, some hitherto unpublished. Volume III (also ca. 580 pages) will comprise *a*) a number of articles by specialists, *b*) over 400 pages of notes by Professor PELLIOT, drawn chiefly from Chinese sources, *c*) an up-to-date bibliography including Chinese editions and articles, *d*) a complete index with cross-references. Volume IV will contain about 60 plates and 20 maps, some drawn especially for this work under the supervision of Professor PELLIOT. Further details may be obtained from the publisher's prospectus, but this summary is sufficient to indicate the magnitude of the work.

Volume II (135 pages) which is here presented to the public, consists of a transcription of a Latin text of MARCO POLO, known as the Z text. Since the full description of this text will not be available until Volume I is published, we must turn to BENEDETTO's introduction to *Il Milione* in order to realize its importance. This work is not readily available, and we may be pardoned for summarizing a number of its points.

It is generally known that the written account of MARCO POLO's

(5) One result of BENEDETTO's work has been to promote investigation of the various families of POLO texts, especially translations. One of the most important of these is the German version represented in an Admont manuscript. This version was studied independently by two scholars who were apparently unaware of each other's investigation. This led to an unfortunate overlapping of publication. See E. H. VON TSCHARNER, *Der mitteldeutsche Marco Polo nach der Admonter Handschrift*, Berlin, Weidmannsche Buchhandlung, 1935 (Deutsche Texte des Mittelalters, XL). Also AGNES HOFFMANN, *Untersuchungen zu den altdeutschen Marco Polo-Texten*, Ohlau i. Schlesien, 1936. (Freiburger Forschungen zur Kunst- und Literaturgeschichte, IV). VON TSCHARNER prints the complete text, and a commentary; Fräulein HOFFMANN does not print the text, and her commentary appears to be less valuable. But it seems that she was first in the field.

travels was prepared during his captivity in Genoa in 1298. It has usually been assumed that POLO dictated his account to a fellow prisoner, one RUSTICHELLO OF PISA, known as a writer of popular prose romances in the Arthurian tradition. BENEDETTO has shown that RUSTICHELLO, in all probability, did not work directly from POLO's dictation, but, rather pieced together a Franco-Italian text, a mosaic based upon notes in which the Venetian traveller had jotted down his experiences of more than thirty years.

Now it has generally been assumed that the original POLO-RUSTICHELLO narrative is faithfully and integrally preserved in a manuscript of the Bibliothèque Nationale, MS. Fr. 1116, usually known as the " geographic " or the F text. Although clearly not the absolute original, it has been held to have virtually the same authority. Its publication in 1824 by the Société de Géographie established the tradition of POLO scholarship which lasted until the appearance of BENEDETTO's *Milione*.

Since, according to this tradition, the F text practically reproduced the original work, it was necessary to explain the variations in other manuscript texts, by postulating a gradual corruption and impoverishment at the hand of later scribes. There were certain difficulties in this view. The most serious obstacle to accepting F as authoritative and exhaustive, lay in the fact that at least one other text contained a substantial group of passages not to be found in F or in any other known source. This text was the one which was published in 1559 by the Venetian RAMUSIO in Volume II of his *Navigationi et Viaggi*. The variants in RAMUSIO's text were so numerous and important that they could not be ignored by the partisans of the F text. Attempts were made to explain them away as corruptions in the manuscripts used by RAMUSIO, or as deliberate falsifications. But the best scholarly opinion, represented by YULE himself, admitted that the discovery of RAMUSIO's sources was the principal task confronting POLO students.

It is perhaps the greatest of BENEDETTO's achievments that he has succeeded in reconstructing in large measure the sources incorporated in RAMUSIO's text. These are seen to be at least five in number. Of these, all except one (and unfortunately for the quality of RAMUSIO's work it was that one on which he chiefly relied) represent a phase anterior to the F text.

The most important of the ante-F texts used by RAMUSIO was indubitably a Latin manuscript " di maravigliosa antichità " to which he himself refers. This manuscript which belonged to a member of the GHISI family at Venice has never been traced. It was BENEDETTO's good fortune, however, to discover in the Ambrosian Library at Milan a late 18th century copy of an earlier Latin manuscript which was clearly

related to the lost source mentioned by RAMUSIO. BENEDETTO labelled this text Z, since the original of the Ambrosian copy was known to have belonged to the library of Cardinal FRANCISCO XAVIER DE ZELADA. In his edition of *Il Milione* BENEDETTO made full use of this important new manuscript, printing extensive variants as footnotes to his basic F version. In this way the importance of the Z text was brought to the attention of scholars. The original Zelada manuscript, however, remained undiscovered. It was known to have been conveyed to the Chapter Library of the Toledo Cathedral, but a number of attempts to locate it there had been unsuccessful.

In 1932 Sir PERCIVAL DAVID, who is to be regarded as the moving spirit behind the present publication, went to Toledo and undertook an extensive search for the missing Zelada manuscript. His persistence was rewarded, and the discovery was publicly announced in 1936 (6). In the meantime the Dean and Chapter of the Toledo Cathedral had granted permission to publish a transcription, a task which was entrusted to the distinguished sinologists Professors MOULE and PELLIOT.

The discovery and publication of the Toledo original is in itself of less importance than BENEDETTO's use of the Ambrosian copy. Nevertheless it is an appreciable service to scholars since the latter has been found to be a not impeccable version of the former. A number of small mistakes and some important ones were made in the 18th century transcription, and these of course could not be corrected until the publication of the present edition. There is, moreover, considerable advantage in having the complete text published consecutively, instead of footnote variants as in *Il Milione*.

We may ask ourselves what is the importance of the discovery of the Z text? Why has it been the occasion of such an ambitious undertaking as the present work? The answer has already been provided by BENEDETTO in his introduction. To advanced students of MARCO POLO the discovery of the Z text is important because of the light which it throws on the entire question of the relationship between the surviving versions of the POLO account. It proves that the F text is not primary in the sense of directly mirroring the original. It does not indeed

(6) The original Zelada manuscript was discovered independently in the Spring of 1932 by an American scholar, J. HOMER HERRIOTT, who announced it in an article "The lost Toledo manuscript of MARCO POLO" in *Speculum* XII (1937), 456-63. HERRIOTT spoke of an intention of publishing the text, but presumably will have abandoned his intention. It is very difficult to understand why duplications of scholarly effort, such as that which has taken place here, and in the case of the German MARCO POLO, are not prevented by the custodians of manuscript collections.—I understand that Mr. HERRIOTT is chiefly interested in the important Catalan version of the POLO narrative.

destroy the pre-eminence of that text, but it does prove that the definitive edition must take account of anterior phases of redaction, more or less clearly represented in other surviving versions. It greatly improves the credit of RAMUSIO by authenticating a large percentage of the passages in which his text differs from all others. It is true that there still remain a number of variants in RAMUSIO for which no manuscript corroboration can be found, not even in Z. The bulk of these are to be found in the first half of the work; in the second half most of his variant passages can be paralleled in Z. This fact has led BENEDETTO to postulate the existence of another version of the same text which he calls Z^1. In all probability Z^1 was none other than the lost GHISI codex of " marvelous antiquity."

We need make no further examination of the textual problem in the state where BENEDETTO has left it, since in all probability the publication of Volume I in the present work will provide the most advanced discussion now possible. It may be worthwhile, however, to point out the significance of these investigations for the ordinary reader of MARCO POLO. For scholars the importance of a reliable text needs no demonstration. But it is not always clear to the general student, that minute critical analysis, such as that carried out by BENEDETTO, accomplishes any useful end.

Now what has been accomplished in the present case is the authentication of a large number of passages, some of the first importance, which could not previously be used in establishing a general reader's text. These additional passages, which will be incorporated in the new translation to be presented in Volume I, do more than add a few minute details. They greatly improve the total picture of MARCO POLO and his astounding exploits. They destroy in large measure the grounds for reproaches made against him for inadequate observation. As BENEDETTO and others have pointed out they show him to have been a true explorer, eager for first hand information, sympathetic and shrewd in his judgment of exotic peoples. We know that he saw China through the eyes of a European and a Christian, yet with an insight which few outsiders have ever achieved. We hear him reproving in the Chinese their tendency toward idolatry and sensual materialism. And yet we find MARCO POLO himself seeking, and successfully obtaining, the intervention of a Chinese idol in restoring a lost ring. The prudent Venetian is careful to add, however, that he had made no offering or special supplication to the obliging deity. All this and more has been added to our knowledge of this prince of travelers through the establishment of the Z text.

What further service will be rendered to scholarship by the publication

of the remaining volumes of this work is still to be seen. But it is clearly appropriate at this point to congratulate the sponsors and the learned editors for their enterprise.

Harvard University DANA B. DURAND

Ernst Zinner.—*Leben und Wirken des Johannes Müller von Königsberg genannt Regiomontanus.* (Schriftenreihe zur bayerischen Landesgeschichte. Herausgegeben v. d. Kommission f. bayerische Landesgeschichte bei der Bayerischen Akademie der Wissenschaften. Band 31). XIII+294 p., 92 figs. München, C. H. BECK, 1938.

This book is the latest contribution by ZINNER to the semimillennial literature on REGIOMONTANUS (1436-1476). Between 1935 and 1937, ZINNER published about ten papers on REGIOMONTANUS, in *Petermanns Mitteilungen*, *Philobiblon*, *Math. u. Naturwiss. Anzeiger d. Ungarischen Akad. d. Wiss.*, *Forschungen und Fortschritte*, *Beiträge zur Inkunabelkunde*, etc.; he also wrote an introduction to the facsimile edition of "Der deutsche Kalender des Johannes Regiomontan, Nürnberg, um 1474" issued in 1937 (*see Isis*, 30, 111-13). As could be expected, ZINNER's latest and fully documented monograph, "Leben und Wirken des ... Regiomontanus," offers to historians of astronomy and to students of scientific incunabula all the information concerning REGIOMONTANUS which is available half a millennium after the birth of the famous computer, instrument maker, and printer. Results of original investigations by ZINNER are blended with detailed discussions of accumulated controversial data, and most of ZINNER's conclusions are convincing enough to be accepted either as established facts or as reasonable hypotheses —until new data should come to light.

According to the table of contents, the book consists of fourteen numbered chapters or sections, of an index, and of 46 plates at the end of the volume. The "reading matter"—as opposed to the reference material—is contained in the first twelve chapters, and ends, on p. 209, as follows :

"Ferner veröffentlichte 1929 L. THORNDIKE eine kleine Abhandlung 'PEUERBACH and REGIOMONTANUS : their great reputation re-examined'... und fand ihre Bedeutung überschätzt. Mit Recht sagte SARTON (*Isis* 14, 238) in seiner Besprechung von THORNDIKES Buch 'THORNDIKE claims that the importance of these two mathematicians has been exaggerated. I am not sure of that. I have been thinking of them, and of their contemporary mathematicians, off and on, for some twenty years, and my admiration for them is still increasing'."

Chapter XIII — Der wissenschaftliche Nachlass REGIOMONTANS und WALTHERS—covers more than sixty pages of fine type and lists or discusses 335 bibliographical items. Chapter XIV—Quellenverzeichnis—

gives, on seven pages, 176 numbered references arranged in the alphabetical order of the names of the authors; there is not a single footnote in the book, reference numbers to quoted sources being inserted, in parentheses, into the "reading matter" of the first twelve chapters; an alphabetically arranged bibliography of all the authors quoted by

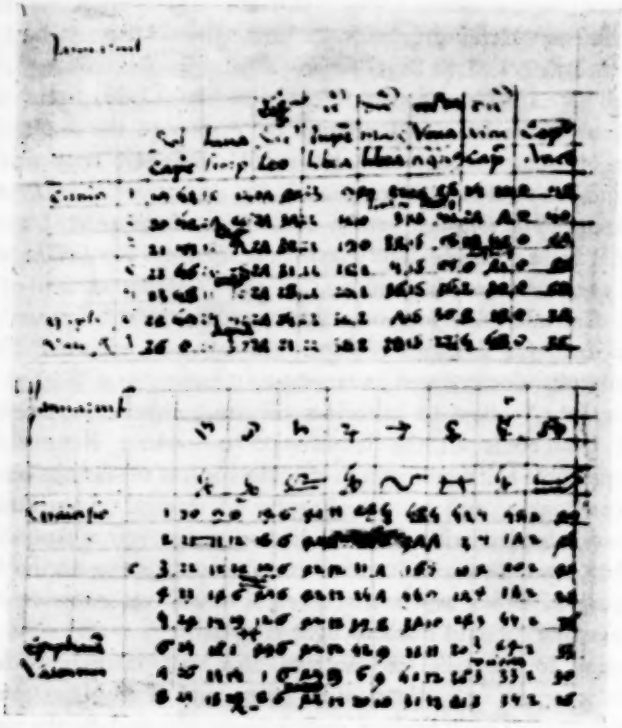

FIG. A and B.—Samples of the handwriting of Regiomontanus. Reduced about one half. *From* : ZINNER, *Leben und Wirken des ... Regiomontanus.*

FIG. A (top), from Vin 4988, 1 verso, reproduces the beginning of the yearbook for 1448; the computer was 12 years old, a student at Leipzig; the positions of the planets are given for every day; the preserved yearbooks of other computers were less complete and less precise.

FIG. B (bottom), from Vin 4988, 13 verso, shows the beginning of the yearbook for 1451.

ZINNER has thus been added to the book, in the form of Chapter XIV, —a convenience which even a reader annoyed by the removal of footnotes ought to be able to appreciate. A detailed index occupies fifteen double-column pages. The value of the book, both to the general reader and to

students of the astronomical or of the bibliographical aspects of the work of REGIOMONTANUS, is increased by the numerous and beautifully reproduced illustrations—portraits, samples of handwriting, title pages, tables, sundials, astrolabes, etc.

A. POGO.

(Regiomontanus).—*Der deutsche Kalender des Johannes Regiomontan, Nürnberg, um* 1474. Faksimiledruck nach dem Exemplar der Preussischen Staatsbibliothek. Mit einer Einleitung von ERNST ZINNER. (Veröffentlichungen der Gesellschaft für Typenkunde des XV. Jahrhunderts—Wiegendruckgesellschaft. Reihe B : Seltene Frühdrucke in Nachbildungen. Band I.). Leipzig, 20+60 pp., figs. OTTO HARRASSOWITZ, 1937.

This is the first volume of a new series—Reihe B will consist of facsimile editions of rare incunabula; Reihe A will continue to offer samples of separate pages, of alphabets, initials, etc., and will, therefore, continue to be of little interest to historians of science. The celebration, in 1936, of the 500th anniversary of the birth of the astronomer and printer, REGIOMONTANUS, is responsible for the choice of this interesting booklet of thirty unnumbered leaves as the first volume of the new series of facsimiles. ZINNER's introduction consists of a short bio-bibliographical sketch, of a description and explanation of the Calendar and of the instruments incorporated in the booklet, and of a discussion of the German technical terms used in the Calendar. There is a bibliographical notice contributed, apparently, by the Gesellschaft für Typenkunde des XV. Jahrhunderts.

This valuable and interesting booklet is known to bibliographers as Hain 13784 or 13785—and is little known to astronomers or even to historians of astronomy : only a score of copies are known to the Kommission für den Gesamtkatalog der Wiegendrucke. Perfect copies are rare : the paper volvelles attached to the INSTRVMENTVM VERI MOTVS LVNAE (leaf 29 verso) and the metallic parts attached to the QVADRATVM HORARIVM GENERALE (leaf 30 verso) are often missing. The Library of Congress copy of the Latin edition of the Calendar (Hain 13775; No. 137 in the Thacher collection of incunabula) is complete and in an excellent state of preservation; the Latin edition was printed by REGIOMONTANUS between 1472 and 1474; the contents of the Latin and of the German editions are essentially the same. Ten pages of the booklet are devoted to eclipses; there are six eclipses to a page, each with a woodcut of the maximum phase; of the 60 eclipses predicted, for the years 1475 to 1530, for Nuremberg, 41 are lunar (9 of them are partial), and 19 are solar (5 of them are partial); ZINNER's statement, on p. 12, that only

" die vollständigen Mondfinsternisse und die grösseren Sonnenfinsternisse " are listed is not correct, as far as lunar eclipses are concerned, and it is misleading, as far as solar eclipses are concerned (e.g., 1497

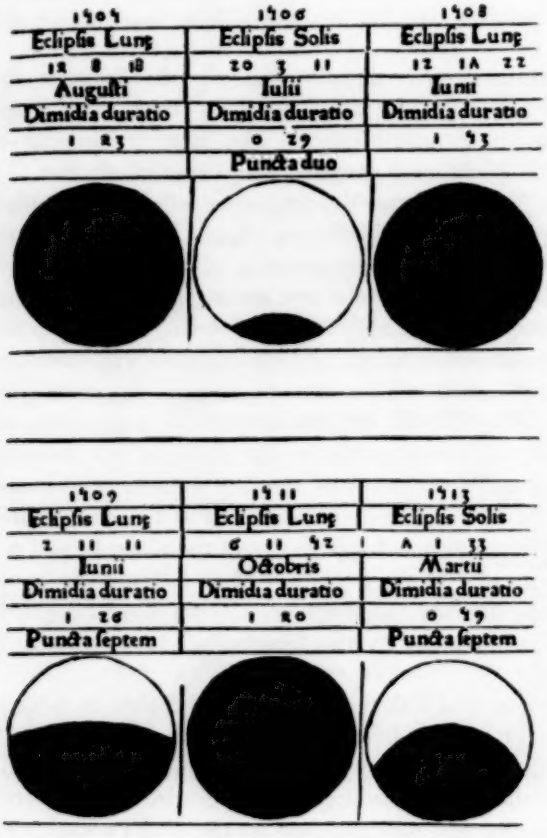

FIG. 1.—REGIOMONTANUS, Calendarium, Nuremberg, ca. 1474. Hain 13775. The horizontal lines measure about 10 1/2 cm.
By courtesy of the Library of Congress

Sample page (17 recto) of the eclipse section. Notice the " Gothic " 4 and 7, e.g., 1505 Augusti 14^{d} 8^{h} 18^{m} and 1513 Martii 7^{d} 1^{h} 33^{m}; in his computations and his letters of this period, R. used the " Arabic " 4 and 7. The little circle on the lunar disk, 1505 Aug. 14, is part of the watermark.

July 29); ZINNER's impression that REGIOMONTANUS did not list partial lunar eclipses may be due to the yellow color applied, in the copies he had seen, indiscriminately to the partially eclipsed sun and to the partially

eclipsed moon. Philologists as well as historians of science ought to be interested in the fact that the words Finsternis (21 verso) and Sonnenuhr (26 recto) were introduced into the German language by REGIO-

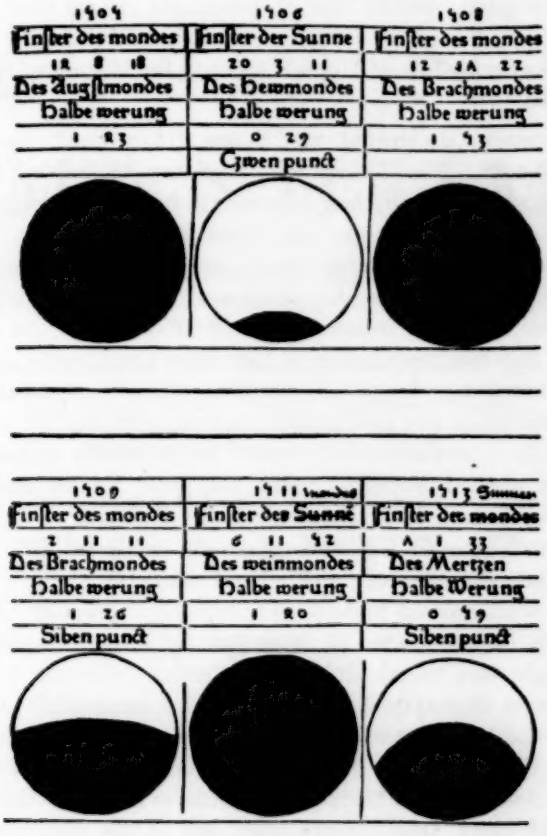

FIG. 2.—REGIOMONTANUS, Kalender, Nuremberg, ca. 1474. Hain 13784 & 13785. The horizontal lines measure about 10 1/2 cm.
From the 1937 *facsimile*

Sample page (17 recto) of the eclipse section. The manuscript corrections, present in all known copies, must have been made by the printer; they do not determine the relative age of the eclipse sections of the Latin and German editions.

MONTANUS in the booklet under review—a booklet which he ends, modestly, with the words "nach meinem slechten tewtsche und chlainem vermoegen."

A. POGO.

Olaus, Rudbeck.—*Atlantica.* Första delen. 590 pages, frontispiece, dedication by author to O. VERELIUS and postscript by editor, AXEL NELSON. Uppsala och Stockholm, ALMQUIST och WIKSELLS, 1937.

The original Swedish text of RUDBECK's *Atland* eller *Manheim*, part I, 1679, edited by AXEL NELSON and republished by Lärdoms-historiska Samfundet af Uppsala (Society for History of Scholarship of Uppsala).

OLOF RUDBECK, designated THE ELDER (1630-1702), was born at Vesterås, Sweden. His father was JOHANNES RUDBECK, bishop of Vesterås, who earlier in life had successively been professor of theology at the University of Uppsala and chaplain to GUSTAVUS ADOLPHUS (1594-1632) during some of the military campaigns of the Swedish king. A son of OLOF, named after his father and known to history as OLOF RUDBECK THE YOUNGER, became professor of botany at the University of Uppsala and was the teacher of LINNEAUS (1707-1778).

OLOF RUDBECK THE ELDER was tenth in a family of eleven children. His early education was received at Vesterås. At the age of eighteen he entered the University of Uppsala. Here, among numerous other subjects, he studied anatomy under JOHANNES FRANK and STENIUS, botany under FRANK, and physiology under STENIUS. These teachers apparently strengthened an interest, already awakened in the boy by his father, in natural history and related subjects.

RUDBECK soon showed himself an independent student. At the age of twenty he began a series of investigations on the lymphatic system which brought him to the attention of Queen CHRISTINA (1626-1689), the daughter of GUSTAVUS ADOLPHUS, who had succeeded to the throne. In April, 1652, he demonstrated his discoveries of the lymph vessels of the liver to the court. On May 22, 1652, he successfully defended the thesis at the University of Uppsala that the liver is not the blood forming organ of the body, thus overthrowing one of the important Galenic doctrines which has held sway for 1,500 years. In the summer of 1653 he published his various discoveries on the lymphatic system under the title : " Nova excercitatio anatomica exhibens Ductus Hepaticus Aquosos et Vasa Glandularum Serosa, nunc primum inventa, aeneisque figuris delineata." In May of the same year THOMAS BARTHOLIN, professor of anatomy at Copenhagen and one of the best known anatomists of his day, had published his treatise : " Vasa lymphatica nuper Hafniae in animantibus inventa," of which RUDBECK did not learn until after his own work was published. A bitter controversy over priority arose, fanned largely by BOGDAN, one of BARTHOLIN's students.

Aided by the royal treasury, RUDBECK went to Holland late in the

summer of 1653 to continue his studies. His brilliant start in the fields of anatomy and physiology gave promise of fruitful results. In the

OLF RUDBEKS

ATLAND

Eller

MANHEIM

Dedan

Japhets affomme/ de förnemſte Keyſerlige och Kungelige Slechter ut till hela werlden/ hemt ett ſyra/ utgångne åro/ ſå och deſſe efterkommande Folck utegade/ nembligen

Skyttar/ Berbarn/ Aſar/ Jettar/ Giotar/ Phryger/ Trojaner/ Amazor/ Traſer/ Erder/ Router/ Tuſſar/ Kaker/ Kempar/ Kuntrar/ Saxer/ Germen/ Swear/ Longobarder/ Wandaler/ Herular/ Geyar/ Todſkar/ Angler/ Pautar/ Danar/ Sicambrer/ och flera de ſom i werlden wiſſa ſtola.

OLAVI RUDBECKII

ATLANTICA

SIVE

MANHEIM

Vera JAPHETI poſterorum ſedes ac patria, ex qua non tantum Monarchiæ & Reges ad totum fere orbem reliquum regendum ac domandum, Stirpeſque ſuas in eo condendas, ſed etiam

Scythæ, Barbari, Aſæ, Gigantes, Gothi, Phryges, Trojani, Amazones, Thraces, Libyes, Mauri, Tuſci, Galli, Cimbri, Cimmerii, Saxones, Germani, Svevi, Longobardi, Vandali, Heruli, Gepidæ, Teutones, Angli, Pictones, Dani, Sicambri,

aliique virtute clari & celebres populi olim exierunt.

UPSALÆ

Excudit HENRICUS CURIO S. R. M. & Academiæ Upſal. Bibliopola.

Netherlands he found so many fascinating fields of knowledge which he sought to master that anatomy had to share his interest with other subjects, especially botany. On his return to Uppsala in 1654 he became

docent in botany. In 1655 he was made adjunct professor of medicine, becoming professor ordinarius in 1660. The following year, at the age of 31, he was appointed rector of the university, and was for many

years the most powerful figure in promoting a period of expansion and modernization of this institution. Among many other improvements may be mentioned that he built an anatomical laboratory, enlarged the library, championed the new philosophy of DESCARTES as against the old scholasticism which still prevailed in the university, and in general,

changed the institution to such an extent that, after his death, it became, with the attraction of LINNEAUS, one of the best known in Europe.

J. A. Pag. 1

OLAVI RUDBECKI
ATLANTICA
SIVE
MANHEIM.
C. Plinio Sec.
BANNOMANNA.
Hodie
SVEONIA.

CAP. I.

De rebus ad juſtam antiquitatis notitiam parandam neceſſariis.

REbus in humanis quoties aliquid occurrit, cujus rimandi vel explicandi rationem, ipſi non tenemus, propterea quod præſentibus eſſe, & oculis id ipſum contueri non licuit, ad id utique in lucem proferendum & ritè explicandum, aliorum fide atque auctoritate opus habemus. Quo autem in unaquaque re, & frequentiora hominum fide dignorum teſtimonia, & plures, quibus peracta fuerit, modi concurrunt, eò etiam plus illi veritatis ineſſe merito arbitramur. Præterea ſi quid usquam aliorum auctoritati fideique tribuendum erit, certè in earum rerum, quæ multò ante nos acciderunt, explicatione idipſum fieri omnino debet. Quapropter ad ea quoque omnia, quæ priſcis temporibus geſta ſunt, inque his, patriæ noſtræ cultum & veteres incolas probè cognoſcendos, tamquam idoneis teſtibus utendum erit: inprimis TRADITIONE, cui etiam omnis hiſtoria, quam literis configu-

CAP. I.

Om de ting ſom fordras att komma till en rett kunſkap i de gamblas handlingar.

ALl ting uthi Werlden / ſom ey igenom närwaroliſe och åſkådande kunna till ſin rätta och egentliga beſkaffenheet uthämptas / beſkrifwas / fattas och dömas / the måſte igenom andras bewittnande låta ſig uthi liuſet föra och ratteligen afdömas. Nu ju flera witnen och omſtändigheeter tillſamma tingz uptychningh finnas / ju troligare är thet till ſin tanningh. Om uthi någon ſaak witnen behöfwas / äro the nyttigaſte uthi nöden / när man will handla om thet ſom uthi gambla tidher är händt och ſkedt. Emwarefore till att någon kundſkap winna om the Gamblas handlingar uthi Werlden / järdeles om wårt Fädernefflands hedna nadt och des Inbyggiare / meſte manſtyr till thenna wittnen / ſom äro / förſt / en SAGA / (traditio) eller berättelſe / hwilcken är grunden till the ſkrefna Sagor eller Hiſtorier. Och finna wij ingen ſkrifwen

RUDBECK continued his botanical studies throughout his life. About 1666 he began the task of publishing in their natural colors, and so far as possible, in natural size, figures of the plants known to him. This

undertaking grew into twelve large volumes, the " Campus Elysii." He was aided in the great task of drawing, engraving and publishing his plates by his son, already named, and by two daughters. In 1702, just as the publication was being completed, fire destroyed much of the city of Uppsala and the fruits of his monumental labors in botany. Originally there were nearly 7,000 plates, of which 6,100, constituting ten volumes of his work, have been recovered.

In spite of these numerous interests, another still more pretentious occupied the uppermost place in his mind for many years before his death. This was a project to correlate everything in ancient and classic literature, biblical story, runic inscriptions and Norse saga which might be interpreted by the widest stretch of imagination to pertain to his native land. This great mass of material he published in four volumes called the " Atlantica." The first volume appeared in 1679 as a folio of eight hundred ninety one pages. Part II was published in 1689, Part III in 1698, and Part IV in 1702. We reproduce reduced facsimiles of the title page of volume I, of its characteristic frontispiece and of the first page of its text. (Courtesy of the Harvard Library). The word Atlantica in the middle of the title page measures 15 cm. in the original.

The wars of GUSTAVUS ADOLPHUS and of his father, CHARLES IX, before him, had resulted in the emergence of Sweden as a world power. The national consciousness and pride were greatly stimulated, and, with these, an interest in the past of its people. A museum of antiquities was established in 1667, into which was gathered everything possible to be secured which related to Sweden's past. Anything which would magnify the importance of its people was accepted with little question. It was the national spirit of the time, not unknown in our day in other lands. This background forms the setting for RUDBECK's " Atlantica." The driving motive was his patriotism and desire to glorify his country.

With this picture of the man we may consider the book with more understanding. It is one of the most remarkable books of the 17th century, and created a widespread interest throughout Europe. It was published in parallel columns of Swedish and Latin, thus being available to the educated world in general. The French ambassador to Sweden is stated to have said that next to his Bible he most assiduously read the " Atlantica." RUDBECK became widely known and acclaimed throughout Europe.

The Latin was a translation from RUDBECK's Swedish manuscript by " en god wän " (a good friend). The editor of the present issue believes this friend to have been ANDREAS NORCOPENSIS. In the dedication to VERELIUS it is stated that the manuscript was completed in 1673, but was revised and expanded before final publication.

There were subsequent editions, during RUDBECK's lifetime, of parts of the work. The first volume was republished in 1696 in Latin text only. Between 1695 and 1700 a new edition of the Swedish and Latin text was issued by RUDBECK. The final volume was not completed until the year of RUDBECK's death.

Lärdomshistoriska Samfundet of Uppsala has undertaken the task of republishing this entire work. Previous proposals have been made to do so, but without coming to fruition. In 1726, twenty-four years after RUDBECK's death, HOFHOUT in Rotterdam issued a prospectus in Latin in which he proposed a new Latin edition of parts 1 to 3 of the "Atlantica." It failed, apparently from lack of subscribers. In 1823 JONSON in Stockholm proposed a Latin edition of the entire four volumes, again without result. This third attempt has now resulted in the 1st volume, beautifully published and substantially bound. It is to be followed at intervals by the remaining three volumes.

In the first volume, now again available, RUDBECK deals with the problem of dispersal of peoples following the flood of Noah. By ingenious calculations and by interpretation of ancient writings he sets forth the thesis that Sweden early was peopled by descendants of Noah. He brings forth arguments to establish the antiquity of its people from consideration of the calendar, shell-mounds, etc. Then follows a long argument to prove that the Scandinavian peninsula was the Atlantis of the ancients. He quotes from the Greek and Latin writers and, in fact, from all literature, showing an amazing knowledge in this field. Philology, etymology, runic inscriptions, mythology, ancient history and geography, all enter into his argument in great detail. The story of the Argonauts becomes the account of a journey to Sweden. The well-known Norse saga of Frithiof becomes the foundation of many of the Greek stories. The entire Greek mythology is explained in terms of Swedish ancient history. There are passages of genius and true scholarship, glimmering, to quote ANNERSTEDT, like nuggets of gold in the unorganized matrix of RUDBECK's own imaginations and citations from authors of all times.

Irrespective of its ability to withstand critical examination as a history of early Sweden, the volume is an encyclopedia of ancient lore, gathered together by a tremendous amount of work. It is easy to understand the effect it had on its contemporaries when first published. In making it again available, the *Lärdomshistoriska Samfundet* and the editor, AXEL NELSON, are making a large contribution to the history of certain aspects of scientific thought in the 17th century.

University of Oregon Medical School. O. LARSELL.

Jitsizô Kuwabara.—*Tô Sô jidai ni okeru Arab-jin no Shina Tsûshô no gaikyô*; *kotoni Sô matsu no Teikyo-shihaku Saiiki-jin Ho Ju-kô no jiseki* [P'U SHOU-KÊNG, a man of the Western Regions, who was superintendent of the Trading Ships' Office in Ch'üan-chou towards the end of the Sung dynasty, together with a general sketch of trade of the Arabs in China during the T'ang and Sung eras] Tokyo, IWANAMI, 1935. 267 pp. folded map. (Yen 3.50).

For about eight hundred years from the beginning of the 8th century to the end of the 15th, the Arabs, starting from the Persian Gulf, crossing the Indian ocean, and passing round the Malay Peninsula, came to Canton where they carried on active trade. In the 9th century, IBN KHORDÂDHBEH, an Arabian geographer, mentioned several Chinese trading ports, and Canton or Kantou as he wrote, was the most prosperous one. Under the Sung dynasty, the offices of the trading ships, the *San-ssu*, for collecting custom-duties and transacting business affairs were established. In the closing years of the Sung, the trade center shifted from Canton to Ch'üan-chou of Fuchien. MARCO POLO and IBN BATÛTA praised this port as the best in the world, and among the Arabs it was known as Zayton, Zaitûn, or Zeytoun.

The Arab traders at the open ports of China lived in a settlement assigned by the Chinese government, but sometimes they lived in the city with the Chinese. Anxious to promote the foreign trade, the government was lenient and the Arabs enjoyed virtually the rights of extraterritoriality. They brought their wives who were known to the Chinese as "Persian women." Emperor KIU CHANG of the Five dynasties (907-959) had a young Arabian woman in his harem. A few traders married Chinese women. A record shows that an Arab marrying a Chinese lady of the Imperial family was promoted to a high official position. Some of the Arabs studied Chinese culture and language.

The Arab traders usually took two years to make a voyage to China and back home. During the Sung and Yüan eras, they bought many ships built in China. With the south-west wind of spring and summer they came and left with the north-east wind of October and December. The Chinese knew comparatively early the polarity of the magnetic needle, but it was the Arabs who applied it to navigation, and the mariner's compass was brought back to China.

The surname of P'U is a transliteration of ABU (ABOU), a common Arab name. The *Sung-shih* records that in the San-fo-ch'i country, a large proportion of the people are surnamed P'u. P'U SHOU-KÊNG's father is fully described in the *Min-shu*. He originally lived in Canton, was the head of the foreign quarters for a long time, and was the richest man in Kuang-tung and Kuang-hsi provinces. After reverses of fortune,

however, P'U K'AI-TSUNG moved to Ch'üan-chou, where his two brave sons, P'U SHOU-KÊNG and P'U SHOU-CH'ÊNG, helped the Chinese authorities to repel the pirates. This probably occurred sometime between 1241-52. P'U SHOU-KENG was made the superintendent of the trade-ships. Later he was made the head of the coast guard. In 1276 when the Sung court fell under the attack of the Mongol general BAYAN, he invited the P'U brothers to side with the Yüan army, but not until the Sung army confiscated ships and provisions, did the P'U brothers join the rebel army. In 1279 when the Mongols finally subjugated the country, P'U SHOU-KÊNG was made a general and the grand commander of Fu-chien and Kuang-tung provinces, and later was promoted to assistant minister of Chiang-hsi province and in a few years made the left vice-minister of Fu-chien province.

The Arabs in China flourished till 1367 when the Emperor T'AI-TSU of Ming issued an anti-foreign proclamation. The government forbade the Chinese to take foreign names, and the Mongols and Westerners to take Chinese names, so that a distinction between superior and inferior races could be kept. On the other hand, due to the fear lest the foreign tribes should increase in number, the government forbade the Mongols and the foreigners to marry among themselves, but allowed them to marry the Chinese. T'AI-TSU suppressed all families with the surname of P'U.

The present work is primarily concerned with P'U SHOU-KÊNG, but Dr. KUWABARA for the first time gives a complete history of the Arabs in China during the T'ang and Sung dynasties and their contribution to the diffusion of Western culture in China and vice versa. The gist of the work was first published in Japanese in 1915 to 1918 in the *Shigaku zasshi*, and the revised and enlarged English version appeared in the *Memoirs* of the Research Department of the Toyo Bunko, nos. 2 (1928) and 7 (1935). The present volume published posthumously incorporates all the notes and corrections made by Dr. KUWABARA in his life time.

SHIO SAKANISHI.

Dietrich Mahnke.—*Unendliche Sphaere und Allmittelpunkt.* Beiträge zur Genealogie der mathematischen Mystik. Halle. NIEMEYER. 1937. VIII+252 pp. RM. 14.50.

This is a history of geometric symbolism in mystic philosophy particularly of "Sphaeroidik," i.e. the doctrine of a metaphysical sphere attached to each being and actuated by the antagonistic forces of "polarity." This symbol applied to the omnipresence and omnipotence of God is expressed by the sentence : Deus est *s p h a e r a* cujus *c e n* -

trum ubique, *circumferentia* nusquam—a concept repeated by innumerable mystic philosophers throughout the ages, and retraced by the author in its fate and origin from the Romantic philosophy (NOVALIS, BAADER, OKEN), through the Baroque period (LEIBNIZ, H. MORE, PASCAL, F. M. VAN HELMONT, SCHEFFLER, BOEHME, COMENIUS), the Renaissance (RABELAIS, BRUNO, FICINO, NICOLAUS CUSANUS, ZORZI, BOVILLUS, REUCHLIN, WEIGEL, COPERNICUS, KEPLER), the Middle Ages (ECKHART, SALOMO BEN GEBIROL), down to BOETHIUS, ST. AUGUSTIN, PLOTIN and the Presocratic philosophers.

It appears that SALOMO BEN GEBIROL is the first mediaeval source to which the concept of the "sphaera intellegibilis" and the theory of relativity of motion can be traced. This becomes the "Sphaera infinita" in the "*Liber XXIV philosophorum*" from which JEAN DE MEUN, THOMAS BRADWARDINE and ECKHART took it. The author of the "Liber XXIV philosophorum" emphasizes the presence of God in every individual as well as in the whole universe, whereby the "sphaera infinita" is constituted. It is in this view derived from the omnipresence of God, whereas ECKHART ascribes to every individual an infinite sphere of his own. It is therefore to ECKHART's credit that the mediaeval symbol of the infinite sphere was preserved in its full significance and found its way into modern philosophy via NICOLAUS CUSANUS and into religious mysticism via RUYSBROEK and the Jesuit CANISIUS. Another Jewish source of geometric mysticism is the Zohar and the inspiration it gave to Renaissance and Baroque philosophy (REUCHLIN, KNORR VON ROSENROTH, F. M. VAN HELMONT, LEIBNIZ), though here the way is paved for arithmetic rather than geometric mysticism. The author believes that REUCHLIN mistook the Zohar and the Liber Yezirah for genuine and ancient Hebrew works, as they are, in the author's opinion, late products developed under influences of Neoplatonism and even GEBIROL's philosophy. Traces of cabbalistic symbolism (e.g. mysticism of numbers) have, however, already been found in the Pentateuch and mathematic symbolism appears to be a genuine Jewish conception independent of Pythagoreism and Neoplatonism. It is a special achievement of MAHNKE that he carefully traces and convincingly elucidates the bearing of mysticism on the actual development of science and philosophy. This particularly appears in the philosophy of NICOLAUS CUSANUS the interpretation of which forms the nucleus of the book. NICOLAUS CUSANUS transfers the geometric symbols from the divine "beyond" to the cosmos and utilizes them in gaining scientific knowledge. Modern scientific cosmology or at least the conception of the world of the stars, infinite and without Centre, appears here as offspring of mathematical mysticism. God must have endowed the world as his creation with

the most perfect shape i.e. that of an *infinite* globe, different from him merely in that the "sphaera infinita" is the *real* geometrical shape of the world and only an approximate symbol of God. From the lack of a centre follows that all celestial bodies and therefore also the earth must be in motion. This, however, should not be taken as a "modern" anticipation of COPERNICUS' doctrine. A comprehensive analysis of the manuscript from 1445 (found by CLEMENS and critically edited by KLIBANSKY) shows that NICOLAUS CUSANUS adequately explains the daily pseudo-motion of the sun and the fixed stars, whereas their yearly and secular motion is not correctly expounded. The planetary motions are not even mentioned. He has not recognized, as COPERNICUS did, that the pseudo-motion exclusively or largely rests with the 3 real motions of the earth. In his view the earth had only 2 slow motions, and the chief part was played by the more rapid motions of the celestial spheres. He sticks to the old geocentric point of view in that he correlates all celestial movements to a system of coordinates fixed in the body of the earth, as this is nearest to the centre of the celestial spheres. It therefore appears that NICOLAUS CUSANUS is no predecessor of COPERNICUS as far as the knowledge of special astronomy is concerned. He lags behind both PTOLEMY and ARISTARCHOS. Special astronomical achievements, however, were not intended by CUSANUS, as he doubted the possibility of overcoming human conjectures because of the deviations of reality from the world of mathematical ideas. His chief concern was the conception of relativity of motion. This leads him to another application of the symbol of the "infinite globe whose centre is everywhere": to the conception of the human individual as an infinite world in itself and of his own, and not merely as a microcosm reflecting the universe and thereby identical with it and all the other smaller worlds. Other examples of the significance of mathematical mysticism for exact science are KEPLER's cosmological and astronomical discoveries based on the cabalistic, Platonic and Pythagorean view that God created the world according to the most perfect harmony of mathematical laws and proportions. The mystic philosophy of space by the Cambridge Neo-Platonist and Cabalist HENRY MORE forms the philosophical centre of NEWTON's cosmophysics, particularly of his doctrine of the simultaneous omnipresence of gravity in the infinite space—and the properties which MORE ascribes to space as a real uncorporeal substance belonging to the divine being can be represented best by the symbol of the infinite globe (his "immensi spiritus *amplitudo*"). OKEN sees organic nature divided into innumerable individuals which, in their smaller particles, visibly repeat the whole—the "Urbläschen" or when higher developed the "cells," i.e. globules whose centre is liquid, while their periphery is solid.

In the reviewer's opinion the author deserves credit for having substantially contributed to our knowledge of the religious and mystic motives and roots of modern science and philosophy. It is particularly the Baroque period and its most brilliant exponent : LEIBNIZ' philosophy in which the significance of old mystic and particularly cabalistic wisdom for modern occidental philosophy becomes most obvious, as already shown by FEILCHENFELD. It is interesting to see from the author's descriptions how these religious and mystic roots are common to human thought, the Persian, the Islamic, the Greek, the occidental, and especially the Jewish world.

Cambridge. W. PAGEL.

Albert Einstein and **Leopold Infeld**.—*The Evolution of Physics.* The Growth of Ideas from Early Concepts to Relativity and Quanta. x+320 pages. New York, SIMON and SCHUSTER, 1938.

In recent years the discoveries of modern physics have been the theme of many popular accounts. The book under review is a distinguished contribution to that field. In thoroughness of treatment and precision of statement it sets a standard that will be difficult to surpass.

The authors state that their intention was to sketch in broad outline the attempts of the human mind to find a connection between the world of ideas and the world of phenomena. They have tried to show the active forces which compel science to invent ideas corresponding to the reality of our world. To borrow a phrase from WHITEHEAD, the book narrates the adventures of ideas in physics. It is stated, " Fundamental ideas play the most essential role in forming a physical theory. Books on physics are full of complicated mathematical formulae. But thought and ideas, not formulae, are the beginning of every physical theory." In view of the scientific standing of the authors it is hardly necessary to emphasize the expertness of the analyses.

The adventures of physical ideas are set forth in four chapters. The first chapter describes the rise of the mechanical view of the physical world. The authors explain the basic concepts of mechanics and describe the creation of modern mechanics by GALILEO and NEWTON. The great results of classical mechanics suggested that the mechanical view can be applied to all branches of physics, that all phenomena can be explained by the action of forces representing either attraction or repulsion, depending only upon distance and acting between unchangeable particles. In the nineteenth century this view was successfully applied to the phenomenon of heat and yielded a kinetic theory of matter. The second chapter sets forth the decline of the mechanical view. Electric and magnetic phenomena were initially explained in terms of the action

of electric and magnetic fluids. Difficulties, however, arose in the explanation of the force between a moving charge and a magnet. The phenomena of light were explained in terms of a wave theory and this created the problem of the mechanism of the ether.

The transition to a new point of view is made in the third chapter entitled " Field, Relativity." The concept of field was initially introduced as something between things interacting at a distance, but eventually it came to be viewed as a fundamental reality. One of the finest features of the book is the thorough explanation of the formulation of MAXWELL's equations describing the structure of the electromagnetic field. Admirable expositions are given of the fundamental ideas of the special and general theories of relativity which arose out of field problems. In the fourth chapter on Quanta, the granular structure of matter and the elementary quanta of matter, electricity, and energy are described. Quantum phenomena have required a further abandonment of the mechanical view. Atomic events can not be described as causal processes in space and time. Quantum physics employs concepts which express probabilities and the basic physical laws determine probabilities.

The book is non-mathematical, but it is doubtful that one unacquainted with the equations of theoretical physics would fully appreciate the careful expositions of electromagnetic theory and relativity. It seems ungrateful to find fault with such an admirable work, but the reviewer can not accept the view that physics began with GALILEO. The statement, " The discovery and use of scientific reasoning by GALILEO was one of the most important achievements in the history of human thought, and marks the real beginning of physics," is an over-simplification which is unfair to ARCHIMEDES, not to mention STEVIN and other early modern workers in mechanics.

University of California, Berkeley. V. F. LENZEN.

Fritz Ferchl.—*Chemisch-Pharmazeutisches Bio- und Bibliographikon.* Herausgegeben von der Gesellschaft für Geschichte der Pharmazie. 2 Bde., 603 S. Mittenwald (Bay.), NEMAYER, 1937-38.

Die Idee dieses Bio-Bibliographikons ist gut ! Nicht Jeder kann sich eben die selten-gewordenen beiden ersten Bände des „POGGENDORFF" (von 1863) „leisten". Denn auf einen quasi-Extrakt daraus läuft das vorliegende Werk hinaus, übrigens Vorworteingestandenermassen. Es sollte überdies die im „POGGENDORFF" von 1863 fühlbare Lücke der Heranziehung hauptsächlich der pharmakomediko-wichtigen Autoren ausgefüllt werden. Ein lobenswertes Unterfangen !

Dass bei einem solchen Werk eine Reihe von Irrtümern, Fehlern und

Missverständnissen dem kritischen Auge sofort bemerkbar wird, ist gewissermassen selbstverständlich. Für eine wünschenswerte zweite Auflage seien hier Beispiel-Fehler-Hinweise vermerkt. Zu ACHARD (Band 1, Seite 2) : Er war nicht „zuletzt Direktor der math.-phys. Klasse der Akademie der Wissenschaften", sondern dies bereits seit 1782 (als Nachfolger MARGGRAF's) und solches nur bis zu seiner Emeritierung (etwa 10 Jahre vor seinem Tode, also nicht bis „zuletzt"). Dass er „die heute noch gültigen Methoden der Rübenzuckerbereitung (gab)" ist nicht gerade zutreffend, man kann heute höchstens noch von der Gültigkeit der Hinweise ACHARDS auf die Rüben-Kultur sprechen. Dass ACHARD seine „erste Fabrik in Cunern 1796" gehabt haben soll, ist ein bedauerlicher Irrtum, da ACHARD sein Gut in Cunern erst seit 1801 in Besitz nahm. Die Angabe, wonach ACHARD „1799 die erste Probe des Rübenzuckers an König Friedrich Wilhelm III. von Preussen (überreicht habe)", ist grundfalsch, da ACHARD diese Proben nicht selbst, sondern nur durch den Generaladjutanten des Königs, den Oberst v. KÖKERITZ, überreichen liess, ohne je eine solche Audienz, beim König, damals oder später, gehabt zu haben ! Und wenn als ACHARDS „Wichtigste Schrift(en) über die Zuckergewinnung..." Der neueste deutsche Stellvertreter des ind. Zuckers oder der Zucker aus Runkelrübe 1799„ hingestellt wird, so fehlt bisher auch nur der Schatten eines Beweises dafür, dass diese Schrift wirklich von ACHARD selbst herrührt. Und wenn dann noch, unter „Ergänzungen und Berichtigungen" (Bd. II, S. 600, Sp. 1) zu S. 2 (von Bd. 1) nachgetragen ist : „Die meisten Abhandlungen ACHARDS erschienen in(!) Journal littér. de Berlin und in Beschäftigungen der Naturforschenden Gesellschaft, Berlin", so wird der aufmerksame Leser der Zeitschrift „Die Deutsche Zuckerindustrie" bzw. von der darin in Heft Nr. 1, S. 69, Nr. 5, S. 152. Nr. 13, S. 315 und Nr. 18, S. 407, erschienenen Bibliographie u.a. von Abhandlungen ACHARDS, sofort merken, dass obiger Erscheinens-Hinweis mit den Tatsachen vollkommen im Widerspruch steht, denn von rund 200 seiner Abhandlungen erschienen im Journ. littér. nur 12 (vgl. Die D.Z. Heft Nr. 5, S. 152-53, die Listen Nr. 88-89), in den Beschäftigungen der Naturf. Gesellsch. gar nur 5 (vgl. D.D.Z. Nr. 13, S. 315, die Listen-Nr. 135-139) Beiträge ! Dagegen erschienen in den Memoiren der Berliner Akademie an 82 Abhandlungen ACHARDS. Dieser bedenkliche Irrtum ist also auszumerzen bzw. zu berichtigen. Auch einige Angeben über sonstige Arbeiten ACHARDS sind nur mit etwas Vorsicht als gültig anzusehen.—Stichwort BASILIUS VALENTINUS (Band I, S. 25-26) : „Manche erblicken in THÖLDE den Verfasser, der tatsächlich eine Anzahl der BASILIUS-Schriften herausgeg. hat, ohne jemals zu behaupten, dass er der Verfasser sei". Es ist FERCHL (oder dessen „Verbesserer", Prof. Dr. SÜSSENGUTH [Vergl.

das Vorwort, unpag. Seite II]) offenbar entgangen, dass SUDHOFF ein Exemplar des „Triumpf Wagen Antimonii Fratris Basilii Valentini, etc." von 1604 besass, auf dessen Titelblatt sich THÖLDE als Autor bezeichnet (Vergl. im „Bibliophilon"— Wien, Jahrgang 1933, S. 163-170, den Beitrag von KARL SUDHOFF über „Die Schriften des sogenannten Basilius Valentinus. Ein Beitrag zur Bibliographie der Alchemie", speziell Seite 168, Spalte 1 des Faksimile bzw. Seite 163, Spalte 2 den Hinweiss auf die Widerung THÖLDES, als Verfasser).

Stichwort KOPP, HERMANN FRANZ MORITZ (Band I, Seite 282-83) führt zum Schluss auf : „in Vierteljahresschr. Zürich : Verwertung einiger Abfälle der Schweizer Industrien 1874". Ein übles Abschreibe- Versehen aus POGGENDORFF ! Denn das bezieht sich auf EMIL und nicht auf HERMANN KOPP !

Und ähnlich so weiter und so weiter, z.B. bei den Stichwörtern BLACK, DAVY, DEYEUX, FARADAY, GÖTTLING, KLAPROTH, etc.

Ein guter Rat : Dieses nützliche Bio-Bibliographikon soll und muss von einer Reihe von Fachgenossen aller Richtungen gründlich „überholt" werden ! Dann wird es erst seinen Zweck vollauf erfüllen ! Wie es *jetzt* ist, kann es nicht als durchaus verlässlich angesehen werden !

MAX SPETER.

The Museum of Modern Art.—Photography, 1839-1937, With an introduction by BEAUMONT NEWHALL. 130 p., 95 pl., New York, 1937.

Not long ago the New York Museum of Modern Art sent on tour an exhibition of photographs illustrating the esthetic development of photography from the earliest efforts of NIÈPCE and DAGUERRE to the latest works of STEICHEN and BOURKE-WHITE. The selection of photographs was all that could be desired, although a little judicious elimination in the contemporary section would have done no harm. It is probable, however, that the excess in that section was due to a desire to attract more visitors.

Only a small but representative selection of the whole exhibit was sent on tour and the greater part of that has now been reproduced in an excellent format, with a very satisfactory historical introduction, a brief bibliography, and a complete catalogue of the exhibition (only 95 of the total 841 photographs have been reproduced). It is regrettable that the editor found it necessary to reproduce so many contemporary pictures of the type that can be found in any photographic journal or annual—particularly as the section on color photography has been completely eliminated.

On looking through the plates I was again forcibly reminded of the

excellence of the early photographs. MARVILLE's picture of the Paris streets (1865) would bear comparison with the best work of today's experts, and GARDNER's photograph of a rebel sharpshooter at Gettysburg could have been a still from JORIS IVENS' *Spanish Earth*.

BEAUMONT NEWHALL, director of the exhibition, has contributed an 80-page historical introduction which is one of the best I have had the pleasure of reading. Despite the fact that it was written for the general public and slurs over all the technical points it is surprisingly well documented and so skillfully carried out that it does not in the least convey a distorted impression.

The only other brief history of photography available to the public is chapter I of NEBLETTE's *Photographic Principles and Practice*, which is technical and not too well written. NEWHALL's account, on the other hand, is as non-technical as possible, and deals very satisfactorily with the causes leading to the frenzied acceptance of the daguerreotype, and the social and artistic implications of photography—subjects which are not even touched on by NEBLETTE. In the absence of any reliable history of photography, the general reader can obtain a satisfactory picture of the evolution of photography from a joint perusal of NEWHALL and NEBLETTE.

A brief but sufficient critical bibliography is provided at the end of the work. I note that POTONNIÉE's one-sided *History of the Discovery of Photography* (*Isis* 8, 511-3) has been translated into English.

This is the first time that I have encountered a brief history of photography that I have felt no qualms in recommending to my friends.

Harvard Observatory. DANIEL NORMAN.

Theodosius Dobzhansky.—*Genetics and the origin of species.* 364 pp. Columbia University Press, New York, 1937.

This is not an ordinary book. Its value, both as a scientific and a historical document is beyond question, yet in spite of its many virtues—and they are many—it has limitations which are quite unexpected in a work of its caliber. No important new book which the reviewer has ever examined, has impressed him as being in such need of a revised and greatly enlarged second edition. This criticism should not imply, of course, that Prof. DOBZHANSKY's work is out of date even in its present form or that it does not meet a long felt want, but rather that it contains a number of passages which could be greatly improved and that certain phases of the work are not adequately developed. These faults could be overlooked more easily in a lesser work but here they are especially irritating, for Prof. DOBZHANSKY's contribution is undoubtedly the best of its kind and approximates closely the work biologists have long been awaiting.

The book opens with a short account of the evolution problem and of the bearing of modern discoveries in genetics upon its solution. Gene mutations are next described and their rate in the formation of new species evaluated. The author is perhaps at his best in his exposition of mutation pressure and of the recently discovered factor which opposes it, the " scattering of variability, " a force which makes for homozygosity in small populations. Few biologists have ever considered the effects of this scattering but now, after DOBZHANSKY's clear and forceful treatment, it will doubtless receive the attention it deserves. The handling of the topics which follow: the chromosome basis of Mendelian inheritance, the role of mutation in the formation of racial and specific differences, and the effects of changes in chromosomes greater than gene mutations are routine but adequate.

We could, perhaps, wish that more emphasis had been given to the recently publicized " positional effect " and the light it sheds upon the nature of mutations, particularly of those clear cut and easily recognized recessive mutations which have occupied so much of the geneticists' attention. On the other hand, the author's discussion of variation in natural populations and of natural selection leaves little to be desired. It may be remarked parenthetically that it is a real pleasure to read an evaluation of natural selection which is intellectually honest, and that the author's own fundamental investigations of natural populations place him in a position to write with authority on the subject. Chapters on polyploidy, isolating mechanisms and hybrid sterility follow and the book ends with a chapter on species as natural units.

DOBZHANSKY's writing is clear and forceful. Indeed many scientists born and raised in English speaking countries might well envy his economical use of words. The mere force of his style, however, gives it overtones which are sometimes rather cocky and every now and then some word is used which is much too emphatic. For example (p. 254) " despite the appallingly insufficient attention that the problem of isolation has received in genetics, etc." Some of this overemphasis gives the impression that the author's emotion is not well controlled. The following passage (p. 126) is undoubtedly the loudest in the book.

" The eugenical Jeremiahs keep constantly before our eyes the nightmare of human populations accumulating recessive genes that produce pathological effects when homozygous. These prophets of doom seem to be unaware of the fact that wild species in the state of nature fare in this respect no better than man does with all the artificiality of his surroundings, and yet life has not come to an end on this planet. The eschatological cries proclaiming the failure of natural selection to operate in human populations have more to do with political beliefs than with

scientific findings." And on the next page (p. 127) "Evolutionary plasticity can be purchased only at the ruthlessly dear price of continuously sacrificing some individuals to death from unfavorable mutations. Bemoaning this imperfection of nature has, however, no place in a scientific treatment of this subject." The author's colleagues should have told him that what he has to say is important, that he will be heard and that it is not at all necessary for him to shout.

There is a bibliography of 28 pages, nearly six hundred titles. To a biologist interested in the history of his subject this bibliography is a disappointment. The reviewer is aware that he may be doing the author an injustice and if his inference is false he apologizes but the impression he gets from the bibliography is that the items come chiefly from the author's private reprint collection. In no other way can he explain the startling omissions of important contributions in a bibliography of this size. For example, JENNINGS published in 1935 a small book entitled *Genetic variations in relation to evolution*. This work is not cited by the author nor does he list more than a third of the papers referred to by JENNINGS. In fact the greater part of the subject matter of this book is omitted. Omitted from the bibliography, also, are such recent books as T. H. MORGAN's *The scientific basis of evolution* (1932) and C. C. HURST's *The Mechanism of Creative evolution* (1932). Incidentally, DOBZHANSKY does not list a single item of which MORGAN is the sole author and he cites none of JENNINGS' papers although the latter's contributions on selection in the protozoa have a direct bearing upon many of his conclusions.

This is not the place to list the many sins of omission. Historians of science should be cautioned, however, to use the bibliography with extreme care, for the author pays little attention to priority. Early original contributions are frequently ignored while later papers, often merely routine investigations, are cited as if they marked real advances in biological theory. There is not the space here to give many examples, although one or two should be pointed out. HARDY's (1908) *Mendelian proportions in a mixed population* is listed but not KARL PEARSON's work which contained the same results and was published four years earlier (*Phil. Trans.* 203 A: 53-86). NILSSON-EHLE's (1908, 1911) fundamental work on duplicate genes is mentioned in the text but not listed in the bibliography. Multiple factor inheritance is illustrated almost exclusively by the work of SUMMER (1923-32) and no mention whatever made of EAST's classic papers of 1910 and 1911 (*Amer. Nat.*). Indeed the author does not seem to realize the importance of multiple factor inheritance in a modern theoretical evaluation of the causes of evolution and he has apparently missed the more recent contributions on the subject by HALDANE (*Genetics*, 1934) and EAST (*Amer. Nat.* 1936).

Similar examples of omissions could be cited almost indefinitely. Indeed the evolution literature is now so enormous that no author could be expected to quote all of the pertinent material. If DOBZHANSKY were writing an ordinary text book, it would be impudent for any reviewer to tell him what illustrative examples he should choose. But this work is an important contribution in the history of evolution and many biologists will doubtless consult it for its literature lists. The author's unfortunate disregard of priority will certainly not help to clarify the already muddled history of the biological sciences.

May we hope that this book will soon appear in a greatly revised and enlarged second edition. There is still a very real need for a work which covers the ground staked out by the title, *Genetics and the origin of species*, and Prof. DOBZHANSKY is obviously the one to give us such a work.

CONWAY ZIRKLE.

Agnes Arber.—*Herbals. Their origin and evolution. A chapter in the history of botany* 1470-1670. New ed. rewritten and enlarged. Frontispiece, XXIV+325 p. 25 pl., 131 fig. University Press, Cambridge; Macmillan Co., New York, 1938. Pr. $7.50.

The first edition of this book appeared in 1912 and was reviewed by SARTON in this journal *(Isis* I : 281-282). The new issue, nearly one fourth larger than the old, is greatly revised and in part rewritten. It is also more copiously illustrated. Indeed this is one of the most beautiful botanical books which has been published in recent years; the paper, type and illustrations leave little to be desired. The text figures are large and clear, many of them filling entire pages and, as they are nearly all reproductions of the old herbal wood cuts, they give the book an added value. Specialists, of course, should be pleased with both the text and the illustrations but the latter should appeal to a great many people, particularly to beginning classes in taxonomy in those institutions where the originals are not available.

After a brief introductory history of early botany, Mrs. ARBER describes such early encyclopedias as *De proprietatibus rerum* of BARTHOLOMAEUS ANGLICUS and *Das Pûch der Natur* of KONRAD VON MEGENBURG. These naturally lead to the *Herbarium* of APULEUS PLATONICUS, the Latin *Herbarius*, the German *Herbarius* and the *Hortus Sanitatis*. A special chapter is devoted to the early history of the herbal in England. The greater part of the work, however, deals with the sixteenth and seventeenth century herbals with especial emphasis upon their taxonomic aspects. Separate chapters are devoted to (1) the evolution of the art of plant description, (2) the evolution of plant classification, (3) the evolution of the art of botanical illustration and (4) the doctrine of

signatures and astrological botany. There are three appendices, the first consisting of a chronological list of the principal herbals and related botanical works published between 1470 and 1670.

Mrs. ARBER has very modestly and accurately described her work as a chapter in the history of botany. Perhaps we have no right to complain, for, within the limits she has set, her work is sufficiently complete; but having perused her offering, we find our interest whetted rather than satisfied. We very definitely want more. Why did she not write two chapters? Or three? Her history of taxonomy during the two centuries her book covers is excellent, although she has confined herself to the printed herbals. Even then, however, botany was more than taxonomy. Agriculture made tremendous gains between 1470 and 1670, and pharmaceutical botany was no mean discipline.

The author has not confined herself too rigorously to the herbals themselves and has frequently taken excursions into contemporaneous botanical works which were related to her main interests. Of course she could not include every important botanical book, but it seems to the reviewer that the *Opus ruralium commodorum* of PIERO DE CRESCENZI, *Res rustica* (Four Bookes of Husbandri) of KONRAD HERESBACH and *De partibus aedium* of GRAPALDUS could have been included with no real loss of unity and with some gain. Other readers will doubtless wish that still other botanists were included, for, even if their exclusion is justified on strictly logical grounds, no one likes to find his favorites left out of the delightful company assembled by the author.

CONWAY ZIRKLE.

Hans Jensen.—*Die Schrift in Vergangenheit und Gegenwart.* Verlag von J. J. AUGUSTIN, Glückstadt und Hamburg, 1935 (Jahreszahl nirgends erwähnt). VIII+418 S., mit 445 Abbildungen. (Preis RM 12.-).

Im Jahre 1925 erschien im Verlage der Orient-Buchhandlung HEINZ LAFAIRE in Hannover HANS JENSENS "*Geschichte der Schrift*" (1). Die Bedeutung dieses Werkes, das zum ersten Male eine umfassende und zuverlässige Darstellung aller bekannten Schriftschöpfungen der Erde und — soweit möglich — ihrer Entwicklungsgeschichte und ihrer Zusammenhänge bot, ist seinerzeit in den Fachzeitschriften gebührend gewürdigt worden. Angesichts der immensen Wichtigkeit, die der Schrift als einem Kulturfaktor, oder besser Kultursymptom, zukommt, lag die Notwendigkeit einer geschlossenen Behandlung der gesamten Materie auf der Hand. Aber tatsächlich gehörte Mut dazu, das Wagnis zu unternehmen, da es doch schlechterdings unmöglich ist, dass ein Einzelner —

(1) VIII + 231 S., mit 303 Abbildungen.

sei er auch noch so belesen, und sei er noch so tief in eine grössere Anzahl von Schriftsystemen eingedrungen — zugleich sämtliche Schriften der Menschheit beherrscht. Denn das Verständnis des Wesens einer Schrift ist ja in vielen Fällen überhaupt völlig verschlossen, wenn man nicht gleichzeitig einen wenigstens oberflächlichen Einblick in den Bau und die charakteristischen Eigenarten der mit der betreffenden Schrift geschriebenen Sprachen, sowie in die Kultur und die Geschichte der verschiedenen Völker gewonnen hat. Es dürfte genügen, in diesem Zusammenhang auf das Schriftsystem der Japaner oder auch auf das Pehlevi-Alphabet hinzuweisen.

Das genannte Werk aus dem Jahre 1925 — das Zeugnis einer ganz ausserordentlichen Sachkenntnis — stellte bereits eine bewunderungswürdige Leistung dar. In einer auch für den Nichtfachmann verständlichen, äusserst fesselnden Weise führte der Verfasser den Leser in all die vielfältigen Systeme ein, deren sich die Menschen bedient haben, um dem gesprochenen Worte Dauer zu verleihen. Dass nicht alle Fragen mit gleicher Vollkommenheit und zur Zufriedenheit aller Kritiker gelöst waren, lag in der Natur der Sache. Denn hier wie überall sonst stehen sich die mannigfachsten Schulmeinungen gegenüber, und kaum wähnt man, einen Zusammenhang bis zur Wurzel erkannt und klargelegt zu haben, da machen neue Funde und Erkenntnisse einschneidende Revisionen unseres Urteils erforderlich.

Gerade das letzte Jahrzehnt hat wiederum in besonders reichem Masse zur Klärung, gleichzeitig aber auch zur Komplizierung verschiedener Gebiete der Schriftgeschichte beigetragen. Eine uralte, zuvor völlig unbekannte Schrift wurde durch die Ausgrabungen Sir John Marshalls im Indusgebiet zu Tage gefördert. Ob ihre Entzifferung jemals gelingen wird, sei dahingestellt. Zu einer optimistischen Beantwortung dieser Frage liegt jedenfalls vorläufig durchaus keine Veranlassung vor, denn die hier zu überwindenden Schwierigkeiten sind unermesslich viel grösser als die, mit denen die Entzifferer der ägyptischen Hieroglyphen oder der Keilschrift zu kämpfen hatten; und Hevesys schöne Entdeckung, dass die Schrift einer verschollenen Bevölkerung der Osterinsel — fast mathematisch genau der Antipoden des Indusvolkes — in ganz verblüffendem Masse mit der Indusschrift übereinstimmt, von der sie durch einen Zeitraum von mindestens drei Jahrtausenden getrennt ist, bringt nur neue, scheinbar unlösbare Rätsel, nicht jedoch den Schlüssel zum Verständnis.

Auch die Ausgrabungen in Ras Schamra, dem alten Ugarit, förderten, neben vielem Anderen, Dokumente ans Licht, beschrieben mit einer Keilschrift-Art, deren Entdeckung für die Forscher ebenso überraschend, wie ihre inzwischen gelungene Entzifferung und Einordnung aufschlussreich und befruchtend war. Neue Probleme erhoben sich hierdurch

für die Frühgeschichte unserer eigenen Schrift, neue Theorien über Abhängigkeiten oder Entlehnungen entstanden, und auch heute noch ist das Schlusswort zu diesem Fragenkomplex nicht gesprochen.

Da auch gleichzeitig die Forschung auf vielen anderen Gebieten der Schriftgeschichte zu neuen Erkenntnissen gelangt war, entschloss sich JENSEN zu einer vollständigen Neugestaltung seiner ersten Darstellung. Als Ergebnis seiner Mühewaltung, für die wir ihm zu grösstem Dank verpflichtet sein müssen, liegt nunmehr ein hinsichtlich der Anlage, ebenso wie auch des Inhaltes und der Ausstattung, grossenteils völlig neues Werk vor, das nicht als umgearbeitete zweite Auflage der „Geschichte der Schrift" gekennzeichnet ist, sondern als selbständige Publikation eines anderen Verlages unter dem neuen Titel „Die Schrift in Vergangenheit und Gegenwart" sich der Öffentlichkeit vorstellt.

Rein äusserlich unterscheidet sich die an Text und Bildmaterial um fast 50 % vermehrte zweite Fassung in mehrfacher Hinsicht von der ersten, und zwar durchweg vorteilhaft : Es ist darauf Wert gelegt worden, dass, soweit irgend möglich, die Illustrationen auf derselben Seite wie der begleitende Text erscheinen, sodass das störende Vor- und Zurückblättern nunmehr wegfällt. Aus ästhetischen Gründen besonders erfreulich ist ferner, dass die Mehrzahl der fremden Schriftarten in elegantem, klaren Typendruck wiedergegeben sind. Dies gilt von den keilschriftlichen Proben, sowie dem *Devanāgarī* und den davon abgeleiteten oder damit näher verwandten Schriften, in noch höherem Masse aber von den chinesischen und japanischen Schriftproben, die ja bekanntlich auf das Auge geradezu verletzend wirken können, wenn sie von nicht sehr geübter Hand ausgeführt sind.

Die Disposition des neuen Werkes ist völlig geändert : Während die erste Fassung nach dem etwas schwer zu umreissenden Gesichtspunkt der „Schriftkategorien" *(Vorstufen der Schrift, Ideenschrift, Wortschrift, Silbenschrift, Buchstabenschrift)* gegliedert war, wodurch mitunter nächst verwandte Schriftarten an ganz verschiedenen Stellen behandelt werden mussten (so z. B. die japanischen *Kana* getrennt vom chinesischen *Ts'ao-shu*, aus dem wenigstens das *Hiragana* direkt hervorgegangen ist), benützt der Verfasser nun den Begriff der „*Schriftenkreise*" und teilt demzufolge sein Werk in 13 vorwiegend regional bedingte Kapitel ein (Kap. IV-XVI), die auf die drei Einführungskapitel (I : *Vorstufen der Schrift*, II : *Ideenschrift (Piktographie)*, III : *Allgemeiner Entwicklungsgang der Schrift*) folgen. Dass auch so Inkonsequenzen nicht immer vermeidbar sind, liegt in der Natur der Sache. Will man in einen und denselben „Schriftenkreis" (analog der Definition des Begriffes „Kulturkreis") prinzipiell nur verwandte Schriftarten einreihen, so fragt es sich, ob man etwa die Schrift der Azteken mit der der Maya zusammenfassen darf,

noch mehr ob die Schriften der Lo-lo, Miao-tzŭ, usw., zusammen mit der chinesischen Schrift zu behandeln sind, oder ob die Indusschrift in dasselbe Kapitel wie die späteren indischen Schriften gehört. In mehreren Fällen sah sich der Verfasser gezwungen, unter Verzicht auf den Begriff der Schriftenkreise einige isolierte Schriftarten nur nach rein geographischen Gesichtspunkten in einem Kapitel zu vereinigen, wie etwa Kap. VI : *Altmittelmeerische Schriften* (Altkretisch, Kyprisch, Hethitisch, Libysch); Kap. VII : *Westafrikanische Schriften* (Nsibidi, Bamum, Vai); Kap. X : *Nordamerikanische Schriften* (Tscherokesisch, Cree). Ich mache diese Feststellungen selbstverständlich nicht als kritischen Einwand, sondern lediglich zur Beleuchtung der Schwierigkeiten, mit denen die Erzielung einer logischen und konsequenten Gliederung des Stoffes notwendig verbunden ist. Tatsächlich hätte wohl eine glücklichere Lösung kaum gefunden werden können, sofern man nicht der eisernen Logik zuliebe dem Stoffe Gewalt antun wollte. In seiner gegenwärtigen Form ist das Werk von einer vorzüglichen Klarheit und Übersichtlichkeit, und in allen seinen Teilen wird der Leser von der meisterlichen Darstellungskunst des Verfassers gepackt.

Bei weitem am ausführlichsten ist natürlicherweise die Darstellung der Kap. XI : *Der semitische Schriftenkreis*, und Kap. XV : *Der griechische Schriftenkreis*. Mit grösstmöglicher Vollständigkeit sind hier so ziemlich alle — auch die absurdesten — Theorien abgehandelt, die jemals zur Klärung der Entstehungsgeschichte unserer Schrift aufgestellt worden sind. Der GARDINER-SETHEschen Hypothese, derzufolge die Sinaischrift das *„missing link* für die Abstammung des phönizischen Alphabets von der ägyptischen Schrift" sein sollte, begegnet der Verfasser mit gebührender Skepsis. Dieselbe ist ja leider inzwischen als „gesicherte Tatsache" von den Neuauflagen der meisten Konversationslexica und Enzyklopädien übernommen worden. Wohl mit Recht weist JENSEN auf die Bedeutung der kretischen Linearschrift der mittelminoischen Periode (1675-1600 v. Chr.) für die Gestaltung der altnordsemitischen Schrift hin. Er referiert in diesem Zusammenhang eine Anzahl von Argumenten, die H. SCHNEIDER (2) zur Stützung seiner Theorie des kretischen Ursprungs der phönizischen Schrift aufgestellt hat. Tatsächlich ist wohl eine direkte Übernahme, bezw. Umdeutung, im Sinne SCHNEIDERS ebensowenig wahrscheinlich, wie die Übernahme aus der Sinaischrift. Sowohl diese, als auch die kretische Linearschrift, mögen jedoch bis zu einem gewissen Grade die äussere Formgebung des frühesten semitischen Alphabets beeinflusst haben. Ohne Zweifel verdienen hier die Ausführungen HANS BAUERS in seiner (nach Erscheinen von JENSENS

(2) *Der kretische Ursprung des phönikischen Alphabets*, Leipzig, 1913.

Werk abgeschlossenen) posthum veröffentlichten Schrift „*Der Ursprung des Alphabets*" (3) Beachtung, deren zusammenfassendes Schlusswort ich hier anführen möchte (S. 43-44) :

„ Unsere Buchstabenschrift ist wahrscheinlich gegen 1300 vor Chr. in Syrien, vermutlich an der Mittelmeerküste (Byblos?) entstanden. Sie war zunächst eine reine Konsonantenschrift mit der Richtung von rechts nach links. Das Prinzip der Konsonantenschreibung stammt, entweder unmittelbar oder vielleicht durch das im benachbarten Ugarit (Ras Schamra) heimische keilschriftliche Alphabet vermittelt, aus Ägypten, wo es sich schon in vorhistorischer Zeit aus der Eigenart des ägyptischen Sprachbaues sozusagen zwangsläufig ergeben hat. Die Schriftzeichen selbst hat der Erfinder wahrscheinlich, wie analoge Beispiele es glaubhaft machen, willkürlich geschaffen, vielleicht mit teilweiser Anlehnung an andere ihm bekannte Schriften; in Betracht käme insbesondere die kretische Linearschrift und eine ältere in Byblos gebrauchte Silbenschrift. Ein *innerer* Zusammenhang zwischen Lautwert und Zeichen, so dass die Zeichen *Bilder* der betreffenden Gegenstände (nach dem Prinzip der Akrophonie) darstellen würden, ist sehr unglaubhaft, dagegen mag in einzelnen Fällen die Gestalt des Zeichens auf dessen *Benennung* (nach dem Prinzip der Akrophonie) Einfluss gehabt haben. Es gibt kein Ur-Alphabet, aus dem das unserige abgeleitet werden könnte oder müsste, vielmehr stehen die ältesten Zeichen, die wir kennen, dem Ur-Alphabet sehr nahe. Auf keinen Fall kann die Sinai-Schrift, von der wir überdies noch nichts mit Sicherheit lesen können, als Vorstufe der unserigen gelten, doch mag sie als Analogon zu ihr betrachtet werden."

Die Auswahl aus der Fülle der Spielarten einer und derselben Schriftgattung ist durchweg sehr glücklich getroffen. In manchen Fällen — besonders wohl dem der arabischen Schrift — ist es wirklich äusserst schwierig, das Wesentliche vom Nebensächlichen zu trennen. Hier hätte es vielleicht wünschenswert erscheinen können, auf die eigentümliche ornamentale Verwendung des kufischen Duktus als „*Quadratisches Kūfī*" in der Architektur durch ein typisches Beispiel zu verweisen, von dem in letzter Zeit A. U. Pope eine Reihe neuer interessanter Proben — auch längerer Inschriften — aus Persien mitgebracht hat. Popes Material ist allerdings leider grösstenteils noch unveröffentlicht. Auch die besonders schöne und eindrucksvolle *Badī'-Schrift*, der Eric Schroeder erst kürzlich einen längeren Artikel gewidmet hat (4), ist

(3) In „*Der Alte Orient*," Band 36, Heft 1/2, Leipzig, 1937; nach des Verfassers Tode herausgegeben von Otto Eissfeld.

(4) " What was the Badī Script?," in *Ars Islamica*, Vol. IV, pp. 232-48, Ann Arbor (Mich.), 1937.

eine so eigenartige — nur zu Unrecht als einfache Abart des *Kūfī* gerechnete — Schöpfung, dass ihre Erwähnung in einer hoffentlich zu erwartenden Neuauflage von JENSENS Werk wohl angebracht wäre.

Schliesslich möchte der Referent noch dem Wunsche Ausdruck verleihen, dass eine Neuauflage auch eine Diskussion der Verwendung der Buchstaben des Alphabets als Zahlzeichen enthalten möge. Die Frage der Übereinstimmung der griechischen mit den semitischen Zahlbuchstaben von 1 bis 80, und ihrer Diskrepanz von 90 an, ist ja aufs engste verknüpft mit der Geschichte des Alphabets selbst. Eine eingehende Auseinandersetzung mit den in den verschiedenen Schriften gebräuchlichen eigentlichen Zahlzeichen und manchen merkwürdigen Parallelen (so etwa zwischen den chinesischen „Soochow"-Zahlzeichen (auch „Ma-tzŭ," 7583, 12324, genannt) und den indischen Kharoṣṭhî-Zahlen) überschritte zwar vielleicht den Rahmen des Werkes, würde aber sicherlich von vielen mit Freuden begrüsst werden, da es ja bis jetzt noch immer an einer geschlossenen Behandlung dieser Frage fehlt.

WILLY HARTNER.

Fifty-fifth Critical Bibliography

of the

History and Philosophy of Science and of the History of Civilization

(to end of July 1938,—with special reference to sections 50 to 58)

This fifty-fifth bibliography contains about 560 items of which 215 deal with sections 50 to 58. They have been kindly contributed by the ten following scholars belonging to three different countries :

C. W. ADAMS (Hertford, England)
M. F. ASHLEY-MONTAGU(Philadelphia)
C. A. KOFOID (Berkeley, Calif.)
C. D. LEAKE (San Francisco)
M. C. LEIKIND (Washington, D. C.)
W. PAGEL (Cambridge, Eng.)
J. PELSENEER (Brussels)
A. POGO (Washington, D. C.)
G. SARTON (Cambridge, Mass.)
C. ZIRKLE (Philadelphia)

This Bibliography includes as usual a series of addenda and errata to SARTON's *Introduction to the History of Science*, vols. 1 and 2 (Baltimore and London, 1927 and 1931). Its purpose and methods have been explained in the preface to the 38th Critical Bibliography (*Isis* 20, 506-08).

Sections 50 to 58 are especially full, as I have liquidated as much as I could of my stock of notes concerning them.

I have in my drawers a large number of notes which I will be glad to publish as soon as I have been able to check them upon the originals.

The Historical and racial classification (Part II) contains a new section (IV), " The New World and Africa " divided into three subsections (*a*) America, (*b*) Oceania, (*c*) Africa. (These subsections have not been numbered in order not to disturb the numbering of sections of Part III).

I entreat the authors of relevant books and papers to send me copies of them *as promptly as possible* in order that their studies may be registered in this bibliography and eventually reviewed and discussed. By so doing they will not simply help me and every other historian of science but they will help themselves in the best manner, for they will obtain for their work the most valuable publicity and its certain incorporation into the literature of the subject.

Many of the notes were checked and the final manuscript and proofs of this Critical Bibliography were kindly read by I BERNARD COHEN and Dr. M. C. WELBORN.

Harvard Library, 185
Cambridge, Mass.

GEORGE SARTON.
August 10, 1938.

PART I

FUNDAMENTAL CLASSIFICATION (CENTURIAL)

VIIth Century B.C.

Thompson, R. Campbell. A survey of the chemistry of Assyria in the seventh century B.C. *Ambix* 2, 3-16, 1938. ISIS

Vth Century B.C.

Kapferer, Richard. Der Blutkreislauf, seine Darstellung in den hippokratischen Schriften. *Hippokrates* H. 28, 697-99, 1937; H. 10, 251-53, 1938. ISIS

IVth Century B.C. (whole and first half)

Strycker, E. de (S. J.). Une énigme mathématique dans l'Hippias Majeur. *Mélanges Émile Boisacq* p. 317-26, Bruxelles, 1937. ISIS

" Au cours d'une discussion sur la nature du Beau, SOCRATE en arrive à soutenir devant HIPPIAS D'ELIS la thèse suivante : il existe des prédicats qui conviennent à un couple de sujets sans convenir en même temps aux éléments de ce couple. Comme le Sophiste se refuse à admettre une affirmation aussi paradoxale, SOCRATE l'appuie par des exemples : pris ensemble nous sommes deux, mais chacun de nous séparément est un; le groupe est pair, les éléments en sont impairs. Revenant plus loin sur le même sujet, il s'exprime en ces termes : ' Lorsqu'un couple est pair, ses éléments séparés peuvent être soit pairs, soit impairs; ou inversement, lorsque certains éléments séparés sont irrationnels, le couple qui en résulte peut être soit rationnel, soit irrationnel '."

IVth Century B.C. (second half)

Lasker, Emanuel. Note on KEYSER's discussion of EPICURUS. *Scripta mathematica* 5, 121-23, 1938. ISIS

IIIrd Century B.C. (whole and first half)

Han Fei tzŭ. Learned celebrities. A criticism of the Confucians and the Moists. Translated by W. K. LIAO. *Harvard journal of oriental studies* 3, 161-71, 1938. ISIS

" This article is one of the best known writings by HAN FEI TZŬ (?-233 B.C.), whose complete works I have recently rendered into English. The

whole translation is based mainly on the best Chinese text, WANG HSIEN-SHÊN's The works of HAN FEI TZŬ with collected commentaries (1895) with the recent explicative edition of the text with a Japanese translation and notes (1931) by T. HIRAZAWA as reference. It will appear in a forthcoming volume together with a companion work, 'HAN FEI TZŬ, the crowning glory of Chinese legalism,' in which I have attempted a critical exposition of the main trends of the author's thought. Inasmuch as it is the first translation of HAN FEI TZŬ's complete works into a Western language, it probably involves incorrect or inaccurate points. Therefore, any emendations or elucidations suggested by the reader will be most welcome."

IInd Century B.C. (whole and first half)

Sarton, George. The tradition of ZENODOROS. Query 73. *Isis* 28, 461-62, 1938. ISIS

Ist Century B.C. (whole and first half)

Neugebauer, O. Über eine Methode zur Distanzbestimmung Alexandria — Rom bei HERON. 26 p. (*Det Kgl. Danske Videnskabernes Selskab. historisk-Fililogiske meddelelser*. 26,2.). København, LEVIN & MUNKSGAARD, 1938. ISIS

"1. In Kap. 35 seiner 'Dioptra' behandelt HERON von Alexandria die Aufgabe, 'auch die Grösse des Weges zwischen zwei Breiten zu bestimmen, wenn Inseln und Meere und vielleicht unwegsame Terrainstrecken auf denselben fallen,' wenn also die früher geschilderten Methoden durch optische Triangulation oder direkte mechanische Messung nicht mehr anwendbar sind. Er behandelt als Beispiel die Aufgabe, 'den Weg zwischen Alexandria und Rom auf gerader Linie oder genauer auf der Peripherie eines der grössten Kreise der Erde zu messen, wofür vorausgesetzt wird, dass der Umfang der Erde 252000 Stadien beträgt, wie der vor andern durch Genauigkeit auf diesem Gebiete ausgezeichnete ERATOSTHENES in der 'Über die Messung der Erde' betitelten Schrift zeigt.' Der Herausgeber und Übersetzer H. SCHÖNE bemerkt zu diesem Kapitel; 'Für dieses schwierige und stark verderbte Kapitel, zu dessen Verständnis noch vieles fehlt, konnte eine genügende Figur nicht gegeben werden.' Ich glaube nun diese Lücke schliessen zu können und damit HERONS Schilderung verständlich zu machen, die uns einen reizvollen Einblick in die mathematische Geographie seiner Zeit vermittelt."

I classify this important paper under 1 (1) B.C. simply to conform with my *Introduction* (1, 208-11), but without committing myself to any dating. Some of HERON's data agree very well with an eclipse of 62 A.D. and the author concludes : "Ich glaube also, dass man HERON entweder an das Ende des ersten Jahrhunderts n. Chr. setzen muss oder alle Daten zwischen etwa — 100 und + 200 als gleichwahrscheinlich ansehen kann." G. S.

Vth Century (whole and first half)

Adontz, N. Sur la date de l'histoire de l'Arménie de MOÏSE DE CHORÈNE.

A propos de l'article de M. HANS LEWY. *Byzantion* 11, 97-100; 597-99, 1936. ISIS

Lewy, Hans. The date and purpose of MOSES OF CHORENE's history. *Byzantion* 11, 81-96; 593-96, 1936. ISIS

VIth Century (second half)

Brunet, F. Œuvres médicales d'ALEXANDRE DE TRALLES, le dernier auteur classique des grands médecins grecs de l'antiquité. Tome I, ALEXANDRE DE TRALLES et la médecine byzantine. III+297 p. 1933. Tome II, Traité des fièvres. Lettre sur les vers intestinaux. Livre premier des douze livres de médecine (affections de la tête). V+259 p., 1936. Tome III, Livre 2. Thérapeutique oculaire; Livre 3. Affections des oreilles et des régions parotidiennes; Livre 4. Affections angineuses; Livre 5. Affections pulmonaires; Livre 6. De la pleurésie; Livre 7. Affections gastriques. IX+254 p., 1936. Tome IV. Livre 7. Affections gastriques; Livre 8. Affections intestinales; Livre 9. Affections hépatiques; Livre 10. Affections abdominales; Livre 11. Affections génito-urinaires; Livre 12. De la podagre. IV+292 p., 1937. Tome V. Reproduction du texte du meilleur ms. grec (sous presse). Paris, GEUTHNER. (Price of the five vols. 300 frs.). ISIS

This is the first French translation of the great Byzantine physician, preceded by a long study on Byzantine medicine and on ALEXANDER OF TRALLES (*Intr.* vol. 1, 453). The author is general doctor of the French navy, and has devoted to this undertaking the leisure time of twenty-five years. He has based his work on the Greek ms. 2201, of Paris, but has referred also to three other MSS of the B. N., and he has made full and constant use of the critical edition of THEODORE PUSCHMANN, with German translation (Vienna 1878-79). Philologists will decide whether BRUNET added anything to PUSCHMANN, or whether his contribution was simply the translation into French. G. S.

VIIth Century (whole and first half)

Taylor, F. Sherwood. The alchemical works of STEPHANOS OF ALEXANDRIA. Translation and commentary. Part II. Letter of the same STEPHANOS to THEODOROS. *Ambix* 2, 38-49, 1938. ISIS

VIIIth Century (second half)

McGeachy, J. A., jr. The *Glossarium Salomonis* and its relationship to the *Liber glossarum*. *Speculum* 13, 309-18, 1938. ISIS

" It is our purpose in this paper, first, to give a brief description of the *Liber glossarum* and its influence; second, to give a detailed explanation of one of the versions thereof, the *Glossarium Salomonis*. In the course of this latter endeavor, our purpose is to show that the prevailing interpretation concerning the channel by which the *Glossarium Salomonis* descended from the *Liber glossarum* is untenable. The *Liber glossarum* was compiled in France, probably at Corbie, in the latter part of the eighth century. Although its chief source was ISIDORE, it drew material also from the Church Fathers, AUGUSTINE, AMBROSE, HILARIUS, EUCHERIUS, FULGENTIUS, and others. Among secular authors it employed as sources the works of OROSIUS, EUTROPIUS, collections of *differentiae*, the *Synonyma Ciceronis*, PLACIDUS, DONATUS, glosses on VERGIL, etc. The *Liber glossarum* was one of the greatest of mediaeval dictionaries, and dominated this field of learning during the early Middle Ages. Because of its great size, the wealth of information which it contained, and the large number of sources from which it drew its material, it became the basis of the larger lexicons of the Middle Ages."

IXth Century (whole and first half)

Abû Ma'shar (*Introduction* 1, 568). The *Flores astrologiae* (*Tractatus Albumasaris florum astrologiae*, printed by RATDOLT in Augsburg 1488 (KLEBS 37.1) was very beautifully reproduced in facsimile by the Deutscher Verein für Buchwesen und Schrifttum (Deutsches Buchmuseum) Leipzig 1928. ISIS

I owe a copy of that elegant volume to my friend Dr. WILLY HARTNER of Bad Homburg. G. S.

Ritter, H.; Walzer, R. Studi su AL-KINDI II. Uno scritto morale inédito di AL-KINDI, TEMISTIO *περὶ ἀλυπίας*? 63 p. (*Reale accademia nazionale dei Lincei, anno* 335, 1938, vol. 8, fasc. 1). Roma, BARDI, 1938. ISIS

Edition of this unpublished text from an Aya Sofya ms. described by RITTER in 1932; Italian version and elaborate introduction. The editors conclude : " Cosi finisce lo scritto sul modo di allontanare la tristezza dall'animo : che noi dunque, fondandoci sulle considerazioni qui sopra esposte, tendiamo a considerare (con ogni prudenza, s'intende), non soltanto come riproduzione di un originale greco, ma proprio di una diatriba perduta di TEMISTIO, di un'opera cioè di una delle spiccate personalità del quarto secolo. Non è oro puro, certo; ma chi, pensoso della continuità della civiltà umana, sia perciò sensibile al fascino particolare che presentano i problemi della tradizione, non può non provare una certa commozione vedendo pensieri, sorti nell'epoca classica della filosofia greca, esercitare ancora una loro notevole efficacia in un ambiente culturale e linguistico totalmente diverso, cui per speciali condizioni storiche sono passati più tardi."

XIth Century (whole and first half)

Ünver, A. Süheyl. L'accusation d'infidélité religieuse de FARABÎ et de IBNI SINA. *Türk tib tarihi arkivi* 2, 75, 1938. ISIS

Ünver, A. Süheyl. Légendes vivantes et perdues dans le folklore oriental concernant IBNI SINA (AVICENNE). *Türk tib tarihi arkivi*, 2, 107-16, 1938 (in Turkish with French summary). ISIS

Ünver, A. Süheyl. Les aphorismes d'IBNI SINA (AVICENNE). *Türk tib tarihi arkivi*, 2, 103-07, 1938 (in Turkish with French summary). ISIS

XIIth Century (whole and first half)

Bédoret, H. (S. J.). Les premières traductions tolédanes de philosophie, Œuvres d'ALFARABI. *Revue néoscolastique de philosophie* 41, 80-97. 1938. ISIS

"Sous l'appellation 'Premières traductions tolédanes de philosophie,' les médiévistes s'accordent actuellement pour désigner l'ensemble des versions arabo-latines que l'archidiacre DOMINIQUE GUNDISALVI (GUNDISSALIMUS) et le juif AVENDAUTH-JEAN DE SÉVILLE firent paraître un peu avant les traductions du fameux GÉRARD DE CRÉMONE (1114-1187). Cet ensemble de versions garde encore des contours assez incertains, mais les richesses qu'il renferme et qu'il apporta aux philosophes scolastiques ne font plus de doute pour personne : on y aperçoit entre autres des œuvres dues aux meilleurs penseurs arabes et juifs, ALKINDI, ALFARABI, AVICENNE, ALGAZEL et AVICEBRON, et l'on croit y discerner le mystérieux *Liber de causis*. Ces traductions soulèvent plusieurs problèmes d'authenticité et de provenance; une bonne moitié d'entre elles — toutes celles des écrits D'AVICENNE — n'ont d'ailleurs pas encore reçu d'édition moderne."

Creutz, Rudolf. Der MAGISTER COPHO und seine Stellung im Hochsalerno. *Archiv für Geschichte der Medizin* 31, 51-60, 1938. ISIS

Parry, John J. GEOFFREY OF MONMOUTH and the paternity of ARTHUR. *Speculum* 13, 271-77, 1938. ISIS

XIIth Century (second half)

Ünver, A. Süheyl. L'écrit du médecin en chef de l'hôpital Adudî de Bagdad, 574 (1178). *Türk tib tarihi arkivi* 2, 91, 1938. ISIS

Wolfson, Harry Austryn. The Aristotelian predicables and MAIMONIDES' division of attributes. *Essays and studies in memory of* LINDA R. MILLER, p. 201-34, 1938. ISIS

"The present paper will confine itself to the single topic of MAIMONIDES' familiar division of attributes into five classes and will endeavor to show how

by drawing upon older sources, and especially upon ARISTOTLE's various classifications of predicables, MAIMONIDES arrived at a new type of classification."

XIIIth Century (second half)

Geyer, Bernhard. Die ALBERT DEM GROSSEN zugeschriebene *Summa Naturalium* (*Philosophia pauperum*). Texte und Untersuchungen. 82 p. (*Beiträge zur Geschichte der Philosophie und Theologie des Mittelalters*, 35, 1). Münster i. W., ASCHENDORFF, 1938 (RM 4.90). ISIS

Elaborate study of the ms. tradition of the *Philosophia pauperum* (for which see my *Introd.* 2, 941), concluding that the balance of probability is in favor of ALBERT OF ORLAMÜNDE as the author, against ALBERT THE GREAT. The introduction (47 p.) is followed by two appendices to the *Summa* and extracts from the text. G. S.

Herriott, J. Homer. A thirteenth-century manuscript of the *Primera Partida*. *Speculum* 13, 278-94, 2 pl., 1938. ISIS

Storch, Edna P. von; Storch, Theo. J. C. von. ARNOLD OF VILLANOVA on epilepsy. *Annals of medical history* 10, 251-60, 1938. ISIS

XIVth Century (whole and first half)

Silverstein, Theodore. On the genesis of *De monarchia*, II, v. *Speculum* 13, 326-49, 1938. ISIS

XIVth Century (second half)

Schäfer, Karl Heinrich. Neue Beiträge zur Geschichte der Medizin im 14. Jahrhundert. II. Eine römische Chirurgen-Rechnung vom Jahre 1369. *Archiv für Geschichte der Medizin* 31, 76-80, 1938. ISIS

XVth Century (second half)

Abravanel, Isaac. Six lectures by PAUL GOODMAN, I. G. LLUBERA, M. GASTER, L. RABINOWITZ, A. R. MILBURN. With an introductory essay by H. LOEWE. Edited by J. B. TREND and H. LOEWE. XXVII+157 p. Cambridge, University Press, 1937. ISIS

Reviewed by JOSEPH SARACHEK, *Jewish quarterly review* 39, 59-61, 1938.

Elgood, Cyril. BAHÁ'-UL-DOULEH and his "Quintessence of experience." *Annals of medical history* 10, 261-65, 1938. ISIS

Klebs, Arnold C. Incunabula scientifica et medica. *Osiris* IV, 1-359, Bruges, St. Catherine Press, 1938. ISIS

Reviewed by A. CORSINI, *Rivista di storia delle scienze mediche* 29, 86, 1938 and by ZAUNICK, *Mitt. z. Gesch. d. Med.* 37, 122, 1938.

Manlius de Bosco, Joannes Jacobus. Das Luminare majus. 1536. Übersetzt und mit Anmerkungen versehen von B. SCHUHMACHER. VIII+336 p. (Hrsg. von der Gesellschaft f. Gesch. d. Pharm.). Mittenwald, NEMAYER, 1936. ISIS

This is a German translation of the " Luminare majus," the pharmacopoeia compiled by MANLIUS DE BOSCO, a XVth century apothecary from Alessandria near Pavia. There are four incunabula editions of it (see KLEBS, Incunabula scientifica, *Osiris* IV, 220), but the author based his translation on a late edition (at least the tenth) printed in 1536. The translation is preceded by a brief introduction dealing with the few bio- and bibliographical data we have about the author and his compilation, and a table of measures and weights translated from NICOLAUS PRAEPOSITUS. Interspersed in the text there are some useful remarks by the translator (a chemist at Juechen/Rhineland) as to the nature and history of drugs and preparations mentioned, based on different sources such as DIOSCORIDES, BLANCARD, BERENDES, etc. There is a short table of synonyms and unusual expressions; there are, however, no critical apparatus, indices or even references of the sources used or quoted which is particularly regrettable in the introduction and the translator's comments. Nevertheless the book is a valuable contribution to the history of pharmacy and medicine, as MANLIUS' pharmacopoeia is the chief source of XVth century pharmacy which had certainly appreciable influence on VALERIUS CORDUS as well as the " Antidotarium Florentinum " (" Ricettario Fiorentino," 1498). W. P.

Vasiliev, A. JÖRG OF NUREMBERG, a writer contemporary with the fall of Constantinople (1453). *Byzantion* 10, 205-09, 1935. ISIS

Leonardo da Vinci

Marcolongo, Roberto. Memorie sulla geometria e la meccanica di LEONARDO DA VINCI. XII+364 p., 36 fig. Napoli, S.I.E.M., 1937. ISIS

This collection of studies on LEONARDO's geometry and mechanics was reprinted in the form of a Presentation volume published on the occasion of MARCOLONGO's retirement as professor of rational mechanics at the University of Naples. We beg the distinguished jubilarian to accept our congratulations and best wishes.

Contents: Arte e scienza di L. D. V.; Le ricerche geometrico-meccaniche di L. D. V.; La meccanica di L. D. V.; Il trattato di L. D. V. sulle trasformazioni dei solidi. G. S.

XVIth Century (whole and first half)

A.—*Mathematics*

Richeson, A. W. Notes on a *Rechenbüchlein* of KONRAD GLASER. *Isis* 28, 341-48, 1938. ISIS

Analysis of a ms. text on commercial arithmetic written by KONRAD GLASER at Nürnberg 1534. "The manuscript is of interest because it furnishes information concerning the methods of writing fractions in use at the time, the value of gold and other commodities in Germany, and particularly at Nürnberg, and the weights and measures of the period, with their variations between different cities and countries."

B.—*Physical sciences and technology*

Oosterhuis, R. A. B. PARACELSUS en HAHNEMANN, een Renaissance der geneeskunst. Met een voorwoord van J. A. J. BARGE. IX+300 p. Leiden, SIJTHOFF, 1937. ISIS

Reviewed by WALTER PAGEL, *Isis* 28, 471-73, 1938.

Strunz, Franz. THEOPHRASTUS PARACELSUS. Idee und Problem seiner Weltanschauung. 2. Auflage. *Deutsche Geistesgeschichte in Einzeldarstellungen*. Herausgeg. v. P. VIRGIL REDLICH. Vol. II, 214 p. Salzburg, PUSTET, 1937. ISIS

Reviewed by WALTER PAGEL, *Isis* 28, 469-71, 1938.

Thorndike, Lynn. Alchemy during the first half of the sixteenth century. *Ambix* 2, 26-37, 1938. ISIS

C.—*Natural sciences*

Bowen, W. H. L'histoire de la terre neuve du Peru. A translation by JACQUES GOHORY. *Isis* 28, 330-40, 2 fig., 1938. ISIS

Caraci, Giuseppe; Destombes, Marcel. LOPO HOMEM and the MILLER atlas of 1519. *Geographical journal* 91, 263-66, 1938. ISIS

Uhden, Richard. An unpublished Portolan chart of the New World, A. D. 1519. *Geographical journal* 91, 44-50, 1938. ISIS

Reproduction and analysis of chart 103 Aug. fol. of the Herzog August-Bibliothek at Wolfenbüttel. C. W. A.

Zweig, Stefan. MAGELLAN. Version française par ALZIR HELLA. XII+289 p. Paris, GRASSET, 1938. ISIS

D.—*Medical sciences*

(Vesalius, Andreas). ANDREAE VESALII bruxellensis *Icones anatomicae*, ediderunt Academia medicinae novaeboracensis et Bibliotheca universitatis monacensis. New York, Academy of Medicine, 1935. ISIS

Reviewed by M. F. ASHLEY-MONTAGU, *Isis* 28, 467-69, 1938.

E.—*Alia*

Delmas, Paul. Les séjours de RABELAIS à Montpellier, 1530-1537. 33 p. VIII[e] Congrès de Thalassothérapie, Montpellier, 1938. ISIS

Friedenwald, Harry. Evidences of tolerance in XVI century Italy. *Bulletin of the institute of the history of medicine* 6, 488-93, 1938. ISIS

Apropos of the oration delivered by CAELIO CALCAGNINI (1479-1541) in granting the doctorate of medicine to "RUBEN THE HEBREW." Facsimile and translation of that oration. G. S.

XVIth Century (second half)

C.—*Natural sciences*

Bowen, Willis Herbert. The earliest treatise on tobacco : JACQUES GOHORY's "Instruction sur l'herbe Petum." *Isis* 28, 349-63, 2 fig., 1938. ISIS

"GOHORY's *Instruction sur l'herbe Petum* (1572) is an important work because it is the first book ever printed with a word meaning tobacco as part of its title. It is valuable also as a document concerning an early French botanical garden of the period when modern botany was beginning. As a work of pharmacology, the *Instruction sur l'herbe Petum* is worthy of study because it gives an account of the first attempts to prepare medicine from tobacco after laboratory experiments; in other words, with the possible exception of NICOLAS MONARDES, JACQUES GOHORY was the first to study the herb from the viewpoint of a chemist and a botanist at the same time."

XVIIth Century (whole and first half)

A.—*Mathematics*

Keyser, Cassius Jackson. A mathematical prodigy : history and legend. *Scripta mathematica* 5, 83-94, 1938. ISIS

Apropos of PASCAL.

Schrecker, Paul. La méthode cartésienne et la logique. *Revue philosophique de la France et de l'étranger* 62, 336-67, 1937. ISIS

B.—*Physical sciences and technology*

Burke-Gaffney, W. (S. J.). MARCO ANTONIO DE DOMINIS (1560-1624). *Isis* 28, 463, 1938. ISIS

McColley, Grant. JOSEPHUS BLANCANUS and the adoption of our word "telescope." *Isis* 28, 364-65, 1938. ISIS

McColley, Grant. The ROSS-WILKINS controversy. *Annals of science* 3, 153-89, 1938. ISIS

"To the reader who has heard little of JOHN WILKINS and less of ALEXANDER ROSS, it may appear paradoxical to state that their controversy has long been known throughout the civilized world. Yet the statement is doubly true, both in a specific and in a general sense. Specifically, each student or lover of literature who has read the dialogue on astronomy that opens Book VIII of *Paradise lost* is well acquainted with its important outlines and many of its phrases, for MILTON's famous dialogue is primarily a digest of the ROSS-WILKINS controversy. Likewise, the controversy is known wherever the age-old struggle between Science and Scriptural literalism is known, for it stands as a representative epitome of this conflict. Whether the question was that of the shape of heaven and earth, so warmly argued during the early Christian era; of antipodes, a moot point during succeeding centuries; of the diurnal and annual motion of the earth, a disturbing problem for decades after 1543; or the doctrine of organic evolution, a conception still proscribed by law in a number of localities, the essential basis of the controversy has remained largely the same — an incompatibility between Scripture, literally interpreted, and the independent conclusions of scientific investigation.

"The protagonist in this controversy, ALEXANDER ROSS, is not unrepresentative of educated men of his day. As DAVID MASSON has justly observed, he was well and favourably known among conservative contemporaries as 'a divine, a poet, and an historian.' He was an encyclopaedic writer, who took all knowledge as his province, and the wholly successful headmaster of the Free School at Southampton. Compared with other men of his generation, Ross appears as a devout if at times bellicose Christian, and his initial assault upon the new astronomy—the *Commentum de terrae motu*, London, 1634—unquestionably resulted from an honest conviction that acceptance of the Copernican hypothesis would prove disastrous to religion. The second attack—*The new planet no planet* (London, 1646)—was, as he candidly admits in the closing paragraph, undertaken 'partly to vindicate my owne credit'."

C.—*Natural sciences*

Eddelbüttel, Heinrich. In Rostock zur Zeit des Dreissigjährigen

Krieges vorkommende Heilkräuter und Zierpflanzen der Gärten. *Archiv für Geschichte der Medizin* 31, 86-120, 1938. ISIS

Apropos of the *Diarium botanicum* of the Rostock professor of poetry PETER LAUREMBERG (1585-1639), preserved in the Rostock University library. G. S.

Ferran, Come. JACQUES CRETENET, chirurgien barbier Lyonnais et fondateur de l'ordre des Josephistes dans cette ville au XVII[e] siècle. *Bulletin de la société française d'histoire de la médecine* 32, 72-100, 1938. ISIS

E.—*Alia*

Coffin, Charles Monroe. JOHN DONNE and the new philosophy. IX+311 p. New York, Columbia University Press, 1937. ISIS

Reviewed by M. F. ASHLEY-MONTAGU, *Isis* 28, 473-75, 1938.

Comenius Society. *Isis* 28, 464, 1938.

XVIIth Century (second half)

A.—*Mathematics*

Lenzen, V. F. NEWTON's third law. *Science* 87, 508, 1938. ISIS

Schrecker, Paul. LEIBNIZ, ses idées sur l'organisation des relations internationales. 39 p. *Proceedings of the British Academy* 23, 1937. ISIS

Schrecker, Paul. MALEBRANCHE et les mathématiques. *Travaux du IX[e] congrès international de philosophie* (Congrès DESCARTES), Paris, 1-6 août 1937, p. 33-40. ISIS

" La philosophie de MALEBRANCHE a servi de cadre à la systématisation des mathématiques du XVII[e] siècle, desquelles elle s'inspire. Éléments qui ont facilité ce rôle : la vérité conçue comme rapport de grandeur, intelligible et réel, entre idées; la déduction, combinaison de rapports; la mathématique représente l'ordre et non la substance des choses; distinction entre *comprendre* et *concevoir*, et théorie de l'infini. Le parallélisme mathématico-théologique et la vision en Dieu de l'étendue et des nombres."

B.—*Physical sciences and technology*

Pilcher, Richard B. " BOYLE's laboratory." *Ambix* 2, 17-20, 7 pl., 1938. ISIS

C.—*Natural sciences*

Rijnberk, G. van (1875-1938). Alle de brieven van ANTONI VAN LEEUWENHOECK. *Bijdragen tot de geschiedenis der geneeskunde* 18, 80-81, 1938. ISIS

D.—*Medical sciences*

Hirschmann, Friedrich. RICHARD WISEMAN. Eine medizinisch-historische Studie. 36 p. (Institut f. Geschichte der Medizin). Leipzig 1937. ISIS

Lombardo, C. GIOVAN COSIMO BONOMO a Pisa. *Rivista di storia delle scienze mediche e naturali* 29, 97-121, 12 fig., 1938. ISIS

Volini, Italo F.; Flaxman, Nathan. BERNARDINO RAMAZZINI (1633-1714), " the father of industrial medicine." *Medical life* 45, 136-52, 1938. ISIS

E.—*Alia*

Gehman, Henry Snyder. MILTON's use of Hebrew in the *De doctrina Christiana*. *Jewish quarterly review* 29, 37-44, 1938. ISIS

Schrecker, Paul. Le parallélisme théologico-mathématique chez MALEBRANCHE. 124 p. *Revue philosophique* mars-avril, 1938. ISIS

Schrecker, Paul. Les diables appelés " MALEBRANCHE." *Revue philosophique* 182-84, mars-avril, 1938. ISIS

Sullivan, J. W. N. ISAAC NEWTON, 1642-1727; with a memoir of the author by CHARLES SINGER. XX+275 pp. MACMILLAN and Co., Ltd., London, 1938 (8 s. 6 d. net). ISIS

Nous résumerons la notice de M. CHARLES SINGER en disant que JOHN WILLIAM NAVIN SULLIVAN (1886-1937) s'est consacré au journalisme scientifique; il n'a pas fait de carrière universitaire; il a été en relations avec MM. EINSTEIN et ALDOUS HUXLEY; au nombre de ses ouvrages, nous mentionnerons ici un petit volume de vulgarisation : *History of Mathematics in Europe from the fall of Greek science to the rise of the conception of mathematical rigour* (1925; *Isis*, 8, 607-8), écrit sous l'influence de M. SINGER; on lui doit aussi un *Beethoven* (1927).

Son *Newton* est un ouvrage posthume, qui doit, paraît-il, beaucoup à Sir ARTHUR EDDINGTON; M. SINGER en a assumé la parution. Il s'agit d'un NEWTON raconté pour le grand public; aucune note, aucune référence bibliographique, pas d'index; les chapitres et les paragraphes n'ont pas de titres; ajouterons-nous qu'il n'y a aucun inédit? Assurons les spécialistes

que ce livre — par ailleurs fort intelligent — ne leur apprendra rien et qu'ils pourront se dispenser de le lire. Ainsi qu'il sied à un exposé populaire, le style est familier; ce NEWTON pour tous ne vise pas à la profondeur; comme il se doit dans ce genre d'ouvrage, l'auteur s'attache particulièrement à l'homme; il est en général au courant de la littérature du sujet; nous n'avons relevé aucune erreur grave (1). J. P.

XVIIIth Century (whole and first half)

A.—*Mathematics*

Agostini, Amedeo. La teoria delle proporzioni in un libretto di GIROLAMO SALADINI. *Atti del 1° Congresso dell' unione matematica italiana*, 453-56. ISIS

" Vogliamo qui riferire brevemente di una esposizione della teoria delle proporzioni, non ancora nota, dovuta a GIROLAMO SALADINI (1731-1813), che fu a lungo iscritto nei rotuli dello Studio bolognese e uno dei primi membri della società dei XL. Esposizione che riteniamo notevole, sia perchè troviamo in essa una nuova forma della definizione di proporzionalità, sia perchè vi troviamo, forse per la prima volta in un' opera a stampa, e certamente indipendentemente da TORRICELLI, la teoria delle proporzioni esposta ricorrendo al concetto di equivalenza."

B.—*Physical sciences and technology*

Dingle, Herbert. SWEDENBORG as a physical scientist. 25 p. London, SWEDENBORG Society, *Transactions*, no. 4, 1938. ISIS

Very suggestive comparison between Swedenborgian and Einsteinian physics. G. S.

Torlais, Jean. Un Rochelais grand-maître de la fran-maçonnerie et physicien au XVIII[e] siècle Le Révérend J. T. DÉSAGULIERS. 40 p., 2 port. La Rochelle, PIJOLLET, 1937. ISIS

C.—*Natural sciences*

Capparoni, Pietro. Di nuovo su VALLISNIERI o VALLISNERI. *Rivista di storia delle scienze mediche e naturali* 29, 85, 1938. ISIS

Fredbärj, Telemak. Ett okänt Linnérecept. *Svenska Linné-Sällskapets* 21, 81-4, 1938. ISIS

The author " deals with a medical prescription by LINNAEUS which he has

(1) Les assertions classiques des pp. 34-35, sont démenties dans notre article : " Lettres inédites de Newton " (à paraître dans *Osiris*). Page 46, SULLIVAN parle de la Portsmouth Collection comme si elle existait encore. Page 60, il donne une date erronée de la mort d'OLDENBURG; mais peut-être n'a-t-il fait que recopier M. MORE (voir notre compte rendu du *Newton* de celui-ci dans *Isis*, vol. 24, n° 67, December 1935, pp. 141-3).

in his possession. So far, about thirty medical prescriptions written by LINNAEUS are known. The one dealt with in this paper seems to have been for a person suffering from an acute fever."

Jacobsson, Nils. Magister ANDREAE HESSELII anmärkningar om HANS RESA till Amerika och vistande där 1711-1724. Ett Delawareminne. *Svenska Linné-Sällskapets* 21, 95-145, 1938. ISIS

In 1938 the U. S. commemorated " the tercentenary of the Swedish settlement in Delaware. Even at the time when the settlement had passed to English hands the Swedish Church sent out clergymen to supply the spiritual needs of the Swedes living there. Quite a number of these clergymen made notes ot the natural conditions of the country, its fauna and its flora, and also of the Indians in those parts. Among these clergymen was one ANDREAS HESSELIUS, rector of Christina (from 1712 to 1724), a place founded by the Swedes on the spot where Wilmington now stands. His annotations, which are reproduced by NILS JACOBSSON, D. D., show him to be a keen observer of flowers and animals. The editor points out, among other things, that HESSELIUS clearly conceived the fertilization of the mulberry tree prior to the publication of VAILLANT's famous treatise of 1717."

Larsson, B. Hjalmar. CAROLUS LINNAEUS, physician and botanist. *Annals of medical history* 10, 197-214, 1 fig., 1938. ISIS

Selling, Olof H. Doktor JÖRGEN HAHNS Musaeum naturae. Ett stort anlagt verk, som aldrig utkom. *Svenska Linné-Sällskapets* 21, 63-80, 3 fig., 1938. ISIS

" Deals with the prospectus of a comprehensive work which an army medical officer at Hamburg, JÖRGEN HAHN, offered for subscription in 1748. It was intended to contain engravings of all kinds of naturalia from different parts of the world. A copy of the prospectus of this apparently fantastic undertaking was sent by HAHN to the Academy of science of Stockholm, whose secretary submitted it to LINNAEUS. The latter at once detected HAHN's inability to complete the task, and he also pointed out that HAHN had freely used LINNAEUS's own words in his presidential address ' On insects ' read before the Academy of science in 1739. He presumed that HAHN had read the address in the Dutch translation, published in 1741, the only translation in existence at the time. The author found a copy of the prospectus, which was considered to be lost, and here publishes its text together with a commentary."

Sundquist, Nils. Botaniska huset under LINNÉS tid. *Svenska Linné-Sällskapets* 21, 1-62, 46 fig., 1938. ISIS

History of LINNAEUS' house in the old botanical gardens, Uppsala, within LINNAEUS' time. G. S.

Uggla, Arvid Hj. Tvenne nya dokument till kännedom om LINNÉS engelska förbindelser. *Svenska Linné-Sällskapets* 21, 85-94, 1938. ISIS

Apropos of DILLENIUS of Oxford and PHILIP MILLER, superintendent of the Apothecaries' garden, Chelsea.

D.—*Medical sciences*

Buwalda, J. Hollandsche vroedvrouwen in Rusland. *Bijdragen tot de geschiedenis der geneeskunde* 18, 128, 1938. ISIS

Laignel-Lavastine, R. L'encrier du Collège de Saint-Côme (1710). *Bulletin de la société française d'histoire de la médecine* 32, 10-12, 1938. ISIS

Van Esso, I. Hollandsche artsen in russischen hof- en staatsdienst in de 18e eeuw. *Bijdragen tot de geschiedenis der geneeskunde* 18, 53-61, 1938. ISIS

Van Esso, I. Hollandsche vroedvrouwen in Rusland in de 18e eeuw. *Bijdragen tot de geschiedenis der geneeskunde* 18, 108-10, 1938. ISIS

E.—*Alia*

Mossner, Ernest Campbell. Bishop BUTLER and the age of reason : a study in the history of thought. New York, MACMILLAN, 1936. ISIS

Reviewed by D. W. PRALL, *Isis* 28, 475-77, 1938.

XVIIIth Century (second half)

A.—*Mathematics*

Loria, Gino. Nel secondo centenario della nascita di G. L. LAGRANGE 1736-1936. *Isis* 28, 366-75, 3 pl., 2 fig., 1938. ISIS

Includes 5 portraits of LAGRANGE, one autograph, two other documents, and a photograph of the impressive monument in Turin. G. S.

B.—*Physical sciences and technology*

Nierenstein, M. BLACK's simplification of BERGMAN's chemical symbols. *Isis* 28, 463, 1938. ISIS

Nikolitch, Georges. ROGER BOCHKOVITCH, 1711-1787. *Ciel et terre* 54, 143-46, 1938. ISIS

Seydl, Otto. Briefe FRANZ XAVER Freiherrn VON ZACH, Direktors der herzoglichen Sternwarte am Gotha-Seeberg und seines Nachfolgers BERNHARDS VON LINDENAU, von 1791-1816 and P. MARTIN ALOIS DAVID, Adjunkt und Direktor der Königlich Prager Sternwarte aus

dem Archiv der Prager Sternwarte. 205 p. (*Publications de l'Observatoire national de Prague*). Prag 1938. ISIS

Smeaton, John. JOHN SMEATON's diary of his journey to the Low Countries, 1755, from the original MS. in the Library of Trinity House, London. With an introduction by ARTHUR TITLEY. IX+68 p., frontispiece, facs. (Newcomen society for the study of the history of engineering & technology, extra publication, 4). Leamington Spa, 1938. ISIS

Speter, Max. ACHARD. *Centralblatt für die Zuckerindustrie* no. 20*b*, 493-502, 6 fig., 1938. ISIS

C.—*Natural sciences*

Van de Velde, Alb. J. J. ANTOINE-AUGUSTIN PARMENTIER en zijn voorgangers (12 aug. 1737 - 13 dec. 1813). *Koninklijke vlaamsche Academie voor taal- en letterkunde; verslagen en mededeelingen*, 841-92, 1937. ISIS

D.—*Medical sciences*

(Knyveton, John). The diary of a surgeon in the year 1751-1752, by JOHN KNYVETON. Edited by ERNEST GRAY. XIV+322 p. New York, APPLETON-CENTURY, 1937. ISIS

Reviewed by M. F. ASHLEY-MONTAGU, *Isis* 28, 478-80, 1938.

Robertson, William Egbert. BENJAMIN RUSH and the medical signers of the Constitution. *Medical life* 45, 129-35, 1938. ISIS

Speter, Max. Die erste promovierte Medizinerin in Deutschland (1754). *Die Frau* 45, 479-86, port., 1938. ISIS

E.—*Alia*

Low, D. M. EDWARD GIBBON, 1737-1794. XIV+370 p. New York, Random House, 1937. ISIS

Reviewed by M. F. ASHLEY-MONTAGU, *Isis* 28, 477-78, 1938.

Williams, David. More light on FRANKLIN's religious ideas. *American historical review* 53, 803-13, 1938. ISIS

XIXth Century (whole and first half)

B.—*Physical sciences and technology*

Bösenberg, H. JOHN LOUDON MACADAM und seine Bedeutung für den Strassenbau. *Technikgeschichte* 23, 24-9, 1934. ISIS

Horton-Smith, L. G. H. FRANCIS BAILY, the astronomer, 1774-1844. A reprint, in revised form, from *The Newburian*, Newbury, Berks, of December 1937. 10 p. Newbury, BLACKET TURNER (1 s.). ISIS

Metzeltin, E. Die ersten deutschen Lokomotivbauer. *Technikgeschichte* 24, 23-8, 4 pl., 1935. ISIS

D.—*Medical sciences*

Céline, Louis-Ferdinand. Mea Culpa & The life and work of SEMMELWEIS. XXIV+175 p. Translated from the French with an Introduction by ROBERT ALLERTON PARKER. Boston, LITTLE, BROWN, 1937. ISIS

Reviewed by M. F. ASHLEY-MONTAGU, *Isis* 28, 484-87, 1938.

Meek, Walter J. BENNETT DOWLER, a forgotten physiologist. *Annals of medical history* 10, 237-46, 1938. ISIS

Musser, Ruth; Krantz, John C., jr. The friendship of General ROBERT E. LEE and Dr. WM. BEAUMONT. *Bulletin of the institute of the history of medicine* 6, 467-76, 1938. ISIS

Wachholz, L. JOHANN NEP. PHILIP RUST. Beitrag zur Geschichte der medizinischen Fakultät in Krakau. *Archiv für Geschichte der Medizin* 31, 40-51, 1938. ISIS

XIXth Century (second half)

B.—*Physical sciences and technology*

(Berry, Arthur). ARTHUR BERRY, historian of astronomy (1862-1929). *Isis* 28, 418-20, 1 pl., 1938. ISIS

Curie, Eve. Madame CURIE (1867-1934). A biography. Translated by VINCENT SHEEAN. XV+393 p., ills. Garden City, N. Y., DOUBLEDAY, DORAN, 1937. ISIS

Reviewed by GEORGE SARTON, *Isis* 28, 480-84, 2 pl., 1938.

Curie, Marie. PIERRE CURIE (1859-1906). Translated by CHARLOTTE and VERNON KELLOGG. With an introduction by Mrs. WILLIAM BROWN MELONEY and autobiographical notes by MARIE CURIE. 242 p., ill. New York, MACMILLAN, 1932. ISIS

Reviewed by GEORGE SARTON, *Isis* 28, 480-84, 2 pl., 1938.

(Ducos du Hauron). Le centenaire de DUCOS DU HAURON. *L'illustration* 96, 149, ill., 1938. ISIS

Gross, Arnold Th. Zeittafel zur Entwicklung der Elektrizitätsversorgung. *Technikgeschichte* 25, 126-38, 2 pl., 1936. ISIS

Jackson, Dugald C. GUGLIELMO MARCONI (1874-1937). *Scientific monthly* 47, 144-51, 1938. ISIS

Miller, Rudolf v. Ein Halbjahrhundert deutsche Stromversorgung aus öffentlichen Elektrizitätswerken. *Technikgeschichte* 25, 111-25, 2 pl., 14 fig., 1936. ISIS

Regaud, Claudius. MARIE SKLODOWSKA-CURIE, 1867-1934. 30 p., 2 ills. Paris, Fondation Curie, 1934. ISIS

Reviewed by GEORGE SARTON, *Isis* 28, 480-84, 2 pl., 1938.

Schulz, E. Geschichte der Städteheizung. *Technikgeschichte* 25, 74-83, 3 fig., 1936. ISIS

Taylor, Lloyd W. The untold story of the telephone. *American physics teacher* 5, 243-51, 10 fig., 1937. ISIS

After the death of ELISHA GRAY (1835-1901) " a scrap of paper was found among his belongings, on which he had written in his quaint scrawl, during some moment of profound discouragement, the following epitaph on the telephone contest : ' The history of the telephone will never be fully written. It is partly hidden away in 20 or 30 thousand pages of testimony and partly lying on the hearts and consciences of a few whose lips are Sealed,—Some in death and others by a golden clasp whose grip is even tighter '."

Thomson, J. J. Recollections and reflections. XIII+451 p. New York, MACMILLAN, 1936. ISIS

Reviewed by M. F. ASHLEY-MONTAGU, *Isis* 28, 487-88, 1938.

(Tyndall, John). A record of the scientific work of JOHN TYNDALL, D. C. L., LL. D., F. R. S. (1850-1888) (By HENRY YOUNG). 38 p. London, Chiswick Press, 1935. ISIS

This bibliography, preceded on page 6 by TYNDALL'S chronology, positions and honors, is divided into 8 sections, each listing his works chronologically. The sections are as follows : 1. Electricity and magnetism; 2. Light and colour; 3. Heat and radiation; 4. Sound and vibration; 5. Water, glaciers and mountaineering; 6. Dust in air and disease; 7. Historical; 8. Biographical. The list is concluded with citations of biographical and obituary notes and an iconography of 4 items. An unfortunate defect of this very valuable bibliography is the lack of inclusive pagination in the citations. A manuscript note in the copy here described informs us that only 200 copies were printed. It is hoped that a sufficient number were distributed to public libraries to make this bibliography of use to the scholarly public. M. C. L.

C.—*Natural sciences*

Miller, Genevieve; Larkey, Sanford V. An exhibit of the works of CLAUDE BERNARD. *Bulletin of the institute of the history of medicine* 6, 649-68, 10 pl., 1938. ISIS

Sa'di, Lutfi M. The life and works of GEORGE EDWARD POST (1838-1909). *Isis* 28, 385-417, 1 pl., 10 fig., 1938. ISIS

With bibliography of the main Arabic writings of GEORGE EDWARD POST, by GEORGE SARTON.

D.—*Medical sciences*

Bernard, Claude, Un inédit de. *Les Nouvelles littéraires*, p. 1, 21 mai, 1938. ISIS

Texte important; fragment d'un cahier inédit autographe, intitulé "Philosophie," et conservé à la maison patrimoniale de Saint-Julien-en-Beaujolais.

(Bowditch, Henry Pickering). By WALTER B. CANNON, *Science* 87, 471-74, 1938. ISIS

Chauvois, Louis. D'ARSONVAL, soixante-cinq ans à travers la science. 437 p., frontispiece, 150 fig. Paris, OLIVEN, 1937 (80 fr.). ISIS

Biographie écrite par un disciple qui a très bien connu D'ARSONVAL, le créateur de la haute fréquence thérapeutique. G. S.

Dorveaux, Paul (1851-1938). Obituary by PAUL DELAUNAY, *Bulletin de la société française d'histoire de la médecine* 32, 20-5, 1 fig., 1938. ISIS

Forel, August (1848-1931). Out of my life and work. 352 p. New York, NORTON, 1937. ISIS

Reviewed by M. F. ASHLEY-MONTAGU, *Isis* 28, 489, 1938.

Frolov, Y. P. PAVLOV and his school. XIX+291 p. London, KEGAN PAUL, 1937. ISIS

Reviewed by M. F. ASHLEY-MONTAGU, *Isis* 28, 488-89, 1938.

Helmholtz, Hermann von. On thought in medicine (Das Denken in der Medizin). An address delivered August 2, 1877, on the

anniversary of the foundation of the Institute for the education of army surgeons. Introduction by ARNO B. LUCKHARDT. Baltimore, Johns Hopkins Press, 1938. ISIS

Hume, Edgar Erskine. STERNBERG's centenary, 1838-1938. *Annals of medical history* 10, 266-72, 1 fig., 1938. ISIS

Larkey, Sanford V. Two letters by JOHN SHAW BILLINGS on the history of medicine. With a foreword. *Bulletin of the institute of the history of medicine* 6, 394-98, 1938. ISIS

(Mitchell, Silas Weir, 1829-1914). By A. J. CARLSON, *Science* 87, 474-78, 1938. ISIS

Pearl, Raymond. Some notes on the contributions of Dr. JOHN SHAW BILLINGS to the development of vital statistics. *Bulletin of the institute of the history of medicine* 6, 387-93, 1938. ISIS

Vallery-Radot, Pierre. La vie ardente de PIERRE-ISAAC POISSONNIER, médecin diplomate (1720-1798). *Bulletin de la société française d'histoire de la médecine* 32, 44-54, 1938. ISIS

Viets, Henry R. West Riding, 1871-1876. *Bulletin of the institute of the history of medicine* 6, 477-87, port., 1938. ISIS

With list of papers published in *The West Riding lunatic asylum medical reports*, 1871-1876.

E.—*Alia*

Ervine, St. John. JOHN TURTLE WOOD, discoverer of the Artemision, 1869. With preface by GEORGE SARTON. *Isis* 28, 376-84, 2 pl., 2 fig., 1938. ISIS

Sidersky, D. Quelques portraits de nos maîtres des études sémitiques. ERNEST RENAN, Marquis DE VOGÜE, CLERMONT-GANNEAU, PHILIPPE BERGER, JOSEPH HALÉVY. 63 p. Paris, GEUTHNER, 1937. ISIS

XXth Century

A.—*Mathematics*

Bryan, George Hartley (1864-1928). Obituary notice by L. BAIRSTOW. *Obituary notices of fellows of the Royal Society* 1, 139-42, port., 1933. ISIS

Fields, John Charles (1863-1932). Obituary notice by J. L. SYNGE. *Obituary notices of fellows of the Royal Society* 1, 131-38, port., 1933. ISIS

B.—*Physical sciences and technology*

Barr, Archibald (1855-1931). Obituary notice by J. W. FRENCH. *Obituary notices of fellows of the Royal Society* 1, 31-6, port., 1932. ISIS

Cattelain, Eugène. L'ypérite ou gaz moutarde. Son histoire, le secret de sa puissance, son avenir. *Revue générale des sciences* 49, 205-11, 322-27, 1938. ISIS

Chapman, Alfred Chaston (1869-1932). Obituary notice by R. ROBISON. *Obituary notices of fellows of the Royal Society* 1, 146-48, port., 1933. ISIS

Clerk, Sir Dugald (1854-1932). Obituary notice by H. R. RICARDO. *Obituary notices of fellows of the Royal Society* 1, 101-02, port., 1933. ISIS

Dye, David William (1887-1932). Obituary notice by E. V. APPLETON. *Obituary notices of fellows of the Royal Society* 1, 75-8, port., 1932. ISIS

Griffiths, Ernest Howard (1851-1932). Obituary notice by Sir W. C. D. DAMPIER. *Obituary notices of fellows of the Royal Society* 1, 15-18, port., 1932. ISIS

Mallock, Henry Reginald Arnulph (1851-1933). Obituary notice by C. V. BOYS. *Obituary notices of fellows of the Royal Society* 1, 95-100, port., 1933. ISIS

Michelson, Albert Abraham (1852-1931). Obituary notice by H. F. NEWALL. *Obituary notices of fellows of the Royal Society* 1, 18-25, port., 1932. ISIS

Rutherford, Lord (1871-1937). Obituary by E. F. BURTON, *University of Toronto quarterly* 7, 329-38, 1938. ISIS

Thomson, John Millar (1849-1933). Obituary notice by Sir HERBERT

JACKSON. *Obituary notices of fellows of the Royal Society* 1, 91-4, port., 1933. ISIS

Threlfall, Sir Richard (1861-1932). Obituary notice by W. B. HARDY. *Obituary notices of fellows of the Royal Society* 1, 45-53, port., 1932. ISIS

Tomlinson, Herbert (1845-1931). Obituary notice by Sir HERBERT JACKSON. *Obituary notices of fellows of the Royal Society* 1, 89-91, port., 1933. ISIS

Yarrow, Sir Alfred Fernandez (1842-1932). Obituary notice by Sir E. H. W. TENNYSON-D'EYNCOURT. *Obituary notices of fellows of the Royal Society* 1, 7-11, port., 1932. ISIS

C.—*Natural sciences*

Alcock, Alfred William (1859-1933). Obituary notice by W. T. CALMAN, S. W. KEMP, P. MANSON-BAHR. *Obituary notices of fellows of the Royal Society* 1, 119-26, port., 1933. ISIS

Bourne, Gilbert Charles (1861-1933). Obituary notice by S. J. HICKSON. *Obituary notices of fellows of the Royal Society* 1, 126-30, port., 1933. ISIS

Bovero, Alfonso (1871-1937). Obituary by H. DE VILHENA, *Arquivo de anatomia e antropologia* 18, 519-37, port., 1937. ISIS

Brachet, Albert A. T. (1869-1930). Obituary notice by J. P. HILL. *Obituary notices of fellows of the Royal Society* 1, 64-70, port., 1932. ISIS

Carpenter, Frank M. WILLIAM MORTON WHEELER. *Isis* 28, 421-23, 1 pl., 1938. ISIS

David, M. Edgeworth. Professor DAVID; the life of Sir EDGEWORTH DAVID. 320 p. London, ARNOLD, 1937. ISIS

Reviewed by R. E. PRIESTLEY, *Geographical journal* 91, 190-91, 1938.

Druce, George Claridge (1850-1932). Obituary notice by A. B. RENDLE. *Obituary notices of fellows of the Royal Society* 1, 12-14, port., 1932. ISIS

Goebel, Karl Ritter von (1855-1932). Obituary notice by F. O. BOWER. *Obituary notices of fellows of the Royal Society* 1, 103-08, port., 1933. ISIS

Gregory, John Walter (1864-1932). Obituary notice by P. G. H. BOSWELL. *Obituary notices of fellows of the Royal Society* 1, 53-9, port., 1932. ISIS

Groom, Percy (1865-1931). Obituary notice by J. B. FARMER. *Obituary notices of fellows of the Royal Society* 1, 63-4, port., 1932. ISIS

Junk, Wilhelm. Das Werden einer grossen Encyclopaedie. Teil II : Die Wahrheit um den C. C. 72 p. 's-Gravenhage, JUNK, 1938. ISIS

In defense of the great Coleopterorum catalogues of which 141 parts (31 vols.) were published from 1910 to 1934 (see *Isis* 25, 241). G. S.

Lusk, Graham (1866-1932). Obituary notice by E. P. CATHCART. *Obituary notices of fellows of the Royal Society* 1, 143-46, port., 1933. ISIS

Matthew, William Diller (1871-1930). Obituary notice by D. M. S. WATSON. *Obituary notices of fellows of the Royal Society* 1, 71-4, port., 1932. ISIS

Newton, Edwin Tulley (1840-1930). Obituary notice by A. S. WOODWARD. *Obituary notices of fellows of the Royal Society* 1, 5-7, port., 1932. ISIS

Stapf, Otto (1857-1933). Obituary notice by A. W. HILL. *Obituary notices of fellows of the Royal Society* 1, 115-18, port., 1933. ISIS

Stephenson, John (1871-1933). Obituary notice by S. W. KEMP. *Obituary notices of fellows of the Royal Society* 1, 149-52, port., 1933. ISIS

D.—*Medical sciences*

Andrewes, Sir Frederick William (1859-1932). Obituary notice by E. B. POULTON. *Obituary notices of fellows of the Royal Society* 1, 37-44, port., 1932. ISIS

Bruce, Sir David (1855-1931). Obituary notice by Sir J. R. BRADFORD. *Obituary notices of fellows of the Royal Society* 1, 79-85, port., 1932. ISIS

Cheyne, Sir William Watson (1852-1932). Obituary notice by W. BULLOCH. *Obituary notices of fellows of the Royal Society* 1, 26-30, port., 1932. ISIS

Fletcher, Sir Walter Morley (1873-1933). Obituary notice by T. R. ELLIOTT. *Obituary notices of fellows of the Royal Society* 1, 153-63, port., 1933. ISIS

Garrison, Fielding H., Letters of. Note by HENRY E. SIGERIST. *Isis* 28, 484, 1938. ISIS

Györy, Tiberius von (1869-1938). Obituary by WALTER VON BRUNN, *Orvosképzés* 313-17, 1938. ISIS

Hume, Edgar Erskine. Fighting typhus fever in Serbia. *Medical life* 45, 99-124, 1938. ISIS

Riesman, David (editor). History of the interurban clinical club, 1905-1937. VII+279 p., illus. Philadelphia, WINSTON (no date, received July 1938). ISIS

History of medical club founded by WILLIAM OSLER. It includes memorials of deceased members and biographies of living ones with an abundance of portraits. It is American medicine in our century. G. S.

Ross, Sir Ronald (1857-1932). Obituary notice by G. H. F. NUTTALL. *Obituary notices of fellows of the Royal Society* 1, 108-15, port., 1933. ISIS

E.—*Alia*

Beit, Sir Otto John (1865-1930). Obituary notice by Sir J. R. BRADFORD. *Obituary notices of fellows of the Royal Society* 1, 60-2, port., 1932. ISIS

Boissacq, Émile. Mélanges ÉMILE BOISSACQ. *Annuaire de l'Institut de philologie et d'histoire orientales et slaves.* Tome V (1937). XVI+561 p., 13 pl. Bruxelles, 1937. ISIS

Commission for relief in Belgium : C. R. B. exchanges. Biographical records, Belgium and the United States, 1920-1936. 131 p. New York, C. R. B. Educational Foundation, 1937. ISIS

A factor of far-reaching importance in the history of science, especially in its international relations, is the C. R. B. Educational Foundation established on unexpended funds raised in the United States for the relief of Belgium during the World War. This fund provides for the mutual interchange of Belgian and American students and scholars by awarding stipends for study and travel in these respective countries. This report gives a history of the Foundation, its administration, conditions of the award of fellowships, and the biographical records of 414 Belgian and 150 American recipients of these awards from 1930 to 1936 with statistical classifications as to institutions of origin and of foreign study and of fields of study. Of the Belgian group, 138 or 33 per cent pursued the medical sciences; 92, or 22 per cent, the applied sciences; and 80, or 19 per cent, the natural and physical sciences. Of the American group 21, or 14 per cent, pursued the medical sciences; 11, or 7 per cent, the applied sciences; and 34, or 23 per cent, the natural and physical sciences. C. A. K.

PART II

HISTORICAL AND ETHNOGRAPHICAL CLASSIFICATION

I.—ANTIQUITY

1.—ANTIQUITY (*generalities*)

Birk, Alfred. Die Strassen des Altertums. *Technikgeschichte* 23, 6-23, 4 pl., 27 fig., 1934. ISIS

Eggers, Gerhard. Wasserversorgungstechnik im Altertum. *Technikgeschichte* 25, 1-12, 10 fig., 1936. ISIS

2.—EGYPT

Edgerton, William F.; Wilson, John A. Historical records of RAMSES III. The texts in Medinet Habu volumes 1 and 2. Transl. with explanatory notes. XV+157 p. (Oriental Institute of the Unv. of Chicago, studies in ancient oriental civilization, 12). Chicago, University Press, 1936. ISIS

Gardiner, A. H. Late Egyptian miscellanies. XXI+142 p. (*Bibliotheca Aegyptiaca*, 7). Brussels, Fondation égyptologique Reine Élisabeth, 1937. ISIS

Hopkins, Arthur John. A defence of Egyptian alchemy. *Isis* 28, 424-31, 1938. ISIS

3.—BABYLONIA AND ASSYRIA

Neugebauer, O. Mathematische Keilschrift-Texte. Erster Teil, Texte, 1935; Zweiter Teil, Register, Glossar, Nachträge, Tafeln, mit 10 Textfiguren und 69 Tafeln, 1935; Dritter Teil, Ergänzungsheft, mit einer Textfigur und 6 Tafeln, 1937. XII+516 p.; IV+66 p., + pl.; VIII+86 p., + pl. ISIS

Reviewed by R. C. ARCHIBALD, *Isis* 28, 490-91, 1938.

Olmstead, A. T. Babylonian astronomy—historical sketch. *American journal of Semitic languages and literatures* 55, 113-29, 1938. ISIS

Thompson, R. Campbell. A survey of the chemistry of Assyria in the seventh century B.C. *Ambix* 2, 3-16, 1938. ISIS

4.—GREECE

Brunn, Walter v. Von der Entwicklung der griechischen Heilkunde. *Zeitschrift für ärztliche Fortbildung* 53, 179-82, 1938. ISIS

Brunn, Walter v. Wie kam die Griechenmedizin zu uns? *Zeitschrift für ärztliche Fortbildung* 53, 207-10, 1938. ISIS

Heidel, William Arthur. The frame of the ancient Greek maps. 141 p. New York, American Geographical Society, 1937. ISIS

Reviewed by AUBREY DILLER, *Isis* 28, 491-93, 1938.

Sticker, Georg. Pharmakologie und Toxikologie bei den Hellenen bis zur Schule des HIPPOKRATES auf Kos. *Archiv für Geschichte der Medizin* 31, 1-39, 1938. ISIS

II.—MIDDLE AGES

6.—MIDDLE AGES (*generalities*)

Ehlers, G. Die Wasserversorgung der deutschen Städte im Mittelalter. *Technikgeschichte* 25, 13-25, 4 pl., 2 fig., 1936. ISIS

Gérold, Théophile. Histoire de la musique des origines à la fin du XIV^e siècle. 423 p., ill. Paris, LAURENS, 1936. ISIS

Reviewed by HENRY COPLEY GREENE, *Isis* 28, 494-502, 1938.

Gérold, Théophile. La musique du Moyen âge. 443 p. Paris, CHAMPION, 1932. ISIS

Reviewed by HENRY COPLEY GREENE, *Isis* 28, 494-502, 1938.

Mengeringhausen, M. Die häusliche Wasserverwendung und Abwasserwirtschaft im Mittelalter. *Technikgeschichte* 25, 43-56, 3 pl., 1936. ISIS

Vignaux, Paul. La pensée au Moyen âge. 208 p. (*Collection Armand Colin, section de philosophie*, no. 207). Paris, COLIN, 1938. (15 fr.). ISIS

" M. PAUL VIGNAUX, qui enseigne à l'École des hautes études l'histoire des doctrines et des dogmes, nous apporte un essai sur la *Pensée* au Moyen âge : ' pensée,' sans doute pour ne pas préjuger s'il s'agit de philosophie ou de théologie; ' théologie,' pourrait-on dire, si l'on voulait caractériser par l'un ou l'autre de ces termes l'ensemble de la spéculation médiévale. Mais un historien craint forcément l'abus de catégories aussi simples, aussi indéterminées. M. PAUL VIGNAUX sait qu'on a trop unifié le Moyen âge, qu'on a isolé de leurs circonstances historiques certains systèmes médiévaux. Aussi s'est-il préoccupé de discerner ' les conditions du XIII^e siècle,' de nous donner le sentiment de sa diversité, de montrer ' Saint THOMAS et son temps,' avec l'évident souci de ne pas réduire au thomisme la pensée du XIII^e siècle, ni, non plus, au siècle de Saint THOMAS, le Moyen âge intellectuel. Le chapitre le plus neuf du livre est celui qui a été consacré à DUNS SCOT et à GUILLAUME D'OCCAM, chapitre où se manifeste une des préoccupations principales de l'auteur : décrire des *modes de pensée*."... " Son ouvrage — qui débute et s'achève par une interprétation de *l'humanisme médiéval*, réel et tendu sous toute cette théologie — est dense, mais clairement construit et vivant."

Winter, Heinrich. Die Nautik der Wikinger und ihre Bedeutung für die Entwicklung der europäischen Seefahrt. *Hansische Geschichtsblätter* 62, 173-84, 1937. Weimar, BÖHLAUS, 1938. ISIS

"Es ist wenig bekannt, dass die Wikinger ausser der magnetischen Nordweisung auch die Breiten- und Längenbestimmung und damit die Elemente der modernen Nautik kannten. Es hat sich gefügt, dass das Buch von NILS WINTHER, *Färöernes Oldtidhistorie*, Kopenhagen 1857, augenscheinlich ganz unbeachtet geblieben und die *Rymbegla*, ein isländisches Kompendium von 1367, herausgegeben 1780 in Kopenhagen, nicht genügend ausgeschöpft worden ist."

7.—BYZANTIUM

Honigmann, Ernest. Les dvandvas dans la toponymie byzantine. *Mélanges Émile Boisacq*, p. 499-512, Bruxelles, 1937. ISIS

Honigmann, Ernest. Pour l'atlas Byzantin. *Byzantion* 11, 541-62, 1936. ISIS

Wellesz, G. Der Stand der Forschung auf dem Gebiete der Byzantinischen Kirchenmusik. *Byzantion* 11, 729-37, 1936. ISIS

III.—ORIENTAL SCIENCE AND CIVILIZATION

8.—WESTERN ASIA (*including "The ancient East" in general*)

Childe, V. Gordon. The oriental background of European science. *Modern quarterly* 1, 105-20, 1938. ISIS

Ünver, A. Süheyl. L'application du Hénné comme traitement de la peste dans l'histoire de la médecine turque. *Türk tib tarihi arkivi* 2, 84-5, 1938. ISIS

10.—CHINA

Britton, Roswell S. A horn printing block. *Harvard journal of Asiatic studies* 3, 99-103, 3 fig., 1938. ISIS

"Wood has been the standard material for printing blocks in China, but for special purposes other materials have been used. Clay blocks and wax composition blocks have been described. The block shown here is a composite of fourteen cross-section cuts of water-buffalo horn. It was used during the Kuang-hsü reign period, 1875-1908, to print deposit receipt blanks of a native bank at Peking. This no doubt explains the use of horn rather than the usual wood. Horn seems to take finer engraving than wood, and so would be preferable for the delicate decoration intended, like decoration on bonds and banknotes, to guard against forgery."

Sung, Z. D. The symbols of Yi King. 159 p., 53 fig., 1934; The text of Yi King. 369 p., 1935. Shanghai, China Modern Education Co. ISIS

Reviewed by J. K. SHRYOCK, *Scripta mathematica* 5, 130-31, 1938. "The reviewer regrets to write that Mr. SUNG has made no further contribution to our knowledge of this classic. In these two volumes he has used LEGGE's English translation almost unchanged, and has applied to it a considerable

amount of what looks at first sight to be mathematics. There are geometrical figures, equations, curves, and all the trappings of mathematics, but to be quite frank, they do not mean a thing. Of course one can play tricks with numbers like 3, 6, 9, and 64, and it is quite accurate to say that 64 is the sixth power of 2. But the reviewer fails to find any significance in this mass of juggled figures. There are also what may be either mistakes or faking. For instance, fig. 51 in the first volume shows the familiar *Yin* and *Yang* symbol as a 'vibration line,' but the curve is not a vibration curve at all."

11.—JAPAN

Fujinami, Gôichi. I-ka sentetsu shôzo shû (A collection of portraits of the Confucian philosophers who practiced medicine). 376 p., 165 portraits. Tokyo, TÔKÔ SHOIN, 1937. ISIS

Reviewed by SHIO SAKANISHI, *Isis* 28, 504-06, 1938.

Rufus, W. Carl. Korean astronomy. 48 p., 17 pl. (*Transactions of the Korea branch of the Royal Asiatic society*, 26), 1936. ISIS

This is a reprint of the paper entitled "Astronomy in Korea" (1936, *Isis* 28, 239) with a new foreword by L. G. PAIK, Director of the Literary dept., Chosen Christian College. It is an important contribution to the history of astronomy in the Far East. Members of the History of Science Society who desire a reprint may apply to the author, Observatory of the University of Michigan, Ann Arbor, Mich. G. S.

12.—ISRAEL

(Including works devoted to Palestine)

Grégoire, Henri. Le "Glozel" Khazare. *Byzantion* 12, 225-66, 1937. ISIS

"Les Khazares sont plus que jamais d'actualité. Les documents écrits en hébreu, et qui prétendent nous donner, à propos de la conversion de ce peuple turc au judaïsme, des renseignements précis sur l'histoire et la géographie de la Khazarie, sont, depuis quelques années, constamment traduits et commentés. On s'efforce d'en tirer parti pour éclairer l'histoire de la Russie primitive. Ils interviennent dans la discussion, toujours plus vive, sur le rôle historique des apôtres des Slaves CYRILLE et MÉTHODE, et sur la valeur de leurs légendes 'pannoniennes.' Un savant russe très distingué, réfugié en Yougoslavie, a écrit, dans trois ou quatre langues, des mémoires étendus fondés principalement sur la littérature khazare. Dans la plupart de ses travaux, l'authenticité du dossier khazare n'est même plus discutée. On l'admet comme évidente. Telle n'était pas cependant l'impression des premiers critiques qui se sont occupés des pièces les plus anciennement connues de ce dossier, suspectes *a priori*. Mais nous assistons à une véritable conspiration tendant à la réhabilitation de textes extrêmement douteux. Seul, dans ces dernières années, le R. P. PEETERS, l'illustre orientaliste et le sagace critique, s'est inscrit en faux contre la *Correspondance khazare*."

Marx, Alexander. The scientific work of some outstanding mediaeval Jewish scholars. *Essays and studies in memory of Linda R. Miller*, 117-70, New York, 1938. ISIS

Meyerhof, Max. Mediaeval Jewish physicians in the Near East, from Arabic sources. *Isis* 28, 432-60, 1938. ISIS

Shunami, Shlomo. Bibliography of Jewish bibliographies. XI+399+IX p. Jerusalem, University Press, 1936. ISIS

Very elaborate bibliography including 2035 items in Hebrew and many other languages, very well classified and fully indexed. Says the author : " The bibliographical needs of a librarian who is occupied with the organization of the Jewish book, and the necessity of satisfying the demands of the readers of the Jewish National and University Library in Jerusalem for material on Jewish matters, gave rise to the idea of compiling a list of Jewish bibliographies. An excellent opportunity to begin the fulfilment of this plan came in 1929 when I spent a year as a member of the staff of the Hebrew Union College Library in Cincinnati and had access to its rich collection of Jewish bibliographical literature. This collection formed the nucleus of my compilation. On my way back to Palestine at the end of 1930, I visited some libraries in the United States and in Europe, adding, as far as the time allowed, the bibliographical material in their collections. The work was completed in the main from the collection in the Jewish National and University Library, of the staff of which I have the honour to be a member, and the remainder was done from material obtained by correspondence with various libraries and bibliographers abroad... In Jerusalem I laboured under the disadvantage of compiling such a work at a distance from the great library centers of Europe and America. Many bibliographical and other details, quite easy to secure in any of these centers, could be obtained here only through lengthy correspondence. This resulted in my being compelled sometimes to do without certain information, especially after November 1933 when the book went to press." The section of special interest to us, " Secular science ", is unfortunately one of the shortest (items 851 to 875). G. S.

14.—ISLAM (*also Arabia*)

Calverley, Edwin E. Islam : an interpretation. *Moslem world* 28, 3-18, 1938. ISIS

" It is the thesis of this article that the description of Islam as totalitarian provides the key for a consistent and comprehensive interpretation of the past history of Islam. Furthermore, this interpretation will reveal the way to a hopeful expectation for the future progress of Islam. This latter subject, however, will be considered at another time."

Hitti, Philip K. History of the Arabs. XVII+767 p. London, MACMILLAN, 1937. ISIS

Reviewed by D. B. MACDONALD, *Isis* 28, 503-04, 1938.

Nemoy, Leon. Notes on some Arabic manuscripts on curious subjects in the Yale University Library. *Papers presented to Professor Andrew Keogh*, 45-66, New Haven, 1938. ISIS

The curious subjects dealt with in these MSS are coffee (text of 1546), genii, tea, Christianity (against), qualities of Ethiopians and Negroes, cooks, stomach-ache, tobacco, sources of the Nile, and mountains of the moon. Some of these treatises were written by AL-SUYÛTÎ. G. S.

Ruska, J.; Garbers, K. Vorschriften zur Herstellung von scharfen Wässern bei JÂBIR und RÂZÎ. *Der Islam* 25, 34 p. (received July 1938). ISIS

Sarton, George. Preface to Volume twenty-eight. A story from the Arabian Nights. *Isis* 28, 321-29, 1938. ISIS

Apropos of a story in the account of Sindibâd the Sailor's fourth voyage (Second Calcutta, 3, 40) and totalitarian " propaganda." G. S.

Spoer, H. Henry. Arabic magic bowls II : an astrological bowl. *Journal of the American oriental society* 58, 366-83, 1938. ISIS

Ünver, A. Süheyl. Les armoires à médicaments dans nos anciennes maisons. *Türk tib tarihi arkivi* 2, 94, 1938. ISIS

IV.—NEW WORLD AND AFRICA

(*a*) AMERICA

Bergsøe, Paul. The metallurgy and technology of gold and platinum among the pre-Columbian Indians. 45 p. (*Ingeniorvidenskabelige Skrifter* Nr. A 44). København, Danmarks Naturvidenskabelige Samfund, 1937. ISIS

Reviewed by M. F. ASHLEY-MONTAGU, *Isis* 28, 529-31, 1938.

Collins, Henry B., jr. Archeology of St. Lawrence Island. Alaska. XI+431 p., 84 pl., 26 fig. (*Smithsonian miscellaneous collections*, 96). Washington, Smithsonian Institution, 1937. ISIS

Reviewed by M. F. ASHLEY-MONTAGU, *Isis* 28, 534-36, 1938.

Cramer, G. F. Determination of a Mayan unit of linear measurement. *American mathematical monthly* 45, 344-47, 1938. ISIS

" The directors who were preparing for the Chicago Fair decided about 1930 to reproduce for the Fair the partly ruined buildings of the Nunnery

Quadrangle at Uxmal in Northern Yucatan. The reproductions were to be constructed as nearly as possible exactly as the original buildings were when new. The careful measurements and scale drawings necessary for this work were made by members of an expedition working under the direction of the department of Middle American research of Tulane University. This paper is concerned with the problem of using the measurements which appear on these plans to determine the size of the previously unknown unit of length which was used in the original structures. The measurements were arranged in order of size and all duplicates were discarded before the following work was started. The set of over a thousand dimensions appearing on the plans was thus cut down to 286. The whole investigation was based on the assumption that any set of measurements of this sort would be almost certain to show a more frequent occurrence of multiples of the unit than of multiples of any other quantity not commensurable with the unit. The set would, however, probably contain many measurements which were not intended to be multiples of the unit and others which were inaccurately measured." The most likely unit is very close to 3 inches. There was perhaps also a unit 20 times larger (five feet). G. S.

Stirling, M. W. Three pictographic autobiographies of SITTING BULL. 56 p., 46 pl. (*Smithsonian miscellaneous collections* 97, Washington, D.C., 1938. ISIS

Underhill, Ruth Murray. Singing for power. VII+159 p. Berkeley, University of California Press, 1938 ($ 2.00). ISIS

An important and delightfully written and produced contribution to the folklore of the Papago Indians of Southern Arizona, *Singing for power* consists of the English translations of what the author has called the " Papago Bible," in which the traditional knowledge is stored, but only in the memory of the singers, and from which the power to manipulate and control the environment is drawn. These songs are excellently rendered by Miss UNDERHILL, who has attempted as far as is possible to preserve the spirit of the originals; the purposes and meaning of the songs are explained by the author, and the whole is interestingly illustrated with the drawings of three Indian boys. A very delightful book. M. F. A.-M.

Vestal, Paul A. Cucurbita moschata found in pre-Columbian mounds in Guatemala. *Botanical museum leaflets*, Harvard University, 6, 65-9, 1938. ISIS

(c) AFRICA (*outside Egypt and Islam*)

Cline, Walter. Mining and metallurgy in Negro Africa. 155 p. (*General series in anthropology*, 5). Menasha, Wisconsin, Banta Publishing Co., 1937. ISIS

Reviewed by M. F. ASHLEY-MONTAGU, *Isis* 28, 522-28, 1938.

Evans-Pritchard, E. E. Witchcraft, oracles and magic among the Azande. With a foreword by C. G. SELIGMAN. XXVI+554 p. New York, Oxford University Press, 1937. ISIS

Reviewed by M. F. ASHLEY-MONTAGU, *Isis* 28, 536, 1938.

Fouché, Leo. Mapungubwe : ancient Bantu civilization on the Limpopo. Reports on excavations at Mapungubwe, Northern Transvaal, from February 1933 to June 1935. Edited on behalf of the Archaeological Committee of the University of Pretoria by LEO FOUCHÉ. XIV+184 p. Cambridge University Press, 1937. ISIS

Reviewed by C. W. HOBLEY, *Geographical journal* 91, 180-82, 1938. "The general conclusions from the culture material are that the first settlers on the site were Sotho-Shona at about, very roughly, A. D. 1500 as compared with the first occupation of Zimbabwe by people of Sotho stock about A. D. 1300. It is thought that around A. D. 1750 there occurred the advent of the Venda people, and that about this time Mapungubwe was abandoned." C. W. A.

Smets, Georges. Quelques observations sur les usages successoraux des Batutsi de l'Urundi. *Bulletin des séances, Inst. Roy. Colonial Belge* 8, 729-40, 1937. ISIS

Smets, Georges. Quelques remarques sur la technique des Barundi. *Archeion* 19, 56-66, 1937. ISIS

Smets, Georges. Commerce, marchés et spéculation chez les Barundi. *Revue de l'Institut de sociologie Solvay* 18, 3-7, 1938. ISIS

Synge, Patrick M. Mountains of the Moon. XXIV+221 p. New York, DUTTON, 1938 ($ 4.00). ISIS

A delightfully written account of an expedition to the equatorial mountains of Africa in search of plants, abundantly illustrated from photographs, sketches, and paintings. There is a discussion of some legends relating to the sources of the Nile. M. F. A.-M.

PART III

SYSTEMATIC CLASSIFICATION

I.—SCIENCE IN GENERAL

15.—BIBLIOGRAPHY OF SCIENCE

Junk, W. Scientiae naturalis bibliographia. Annus I : 1937, part 2, p. 71-141, The Hague, JUNK, 1938. ISIS

16.—HISTORY OF SCIENCE

Curt, Ralph H. The story of discovery and invention. How the wonders of the modern world came into being. VIII+568 p., 16 pls., 125 fig. New York, HILMAN-CURL, 1937 ($ 1.50). ISIS

This account of the applications of scientific discoveries to human needs and of inventions of significance in human culture is noteworthy for several reasons. It traces the relations of basic discoveries to subsequent applications, as for example, the discoveries by PASTEUR of the germs of disease, and their consequences in the fields of sanitary engineering and preventive medicine. It gives the history of each major field of inventive activity and is quite comprehensive, presenting well-balanced accounts of all of the major fields which have materially influenced civilization.

As a general background the author reviews the achievements of primitive man, the growth of discoveries in the earliest civilizations, English life in the Middle Ages and in the 18th century, and the rise of the Machine Age. The major part of the book is taken up with historical accounts of scientific and industrial progress in various fields such as warfare; agriculture; food preservation; medicine; sanitation; modes of transportation; sources of power; engines; electricity; transmission of words by telegraph, telephone, and wireless; metallurgy; textiles; printing; acoustics; photography and cinema; and automatic and time-saving devices. A chapter is devoted to the slow recognition of the place and value of scientific theory and its recent developments, and the closing chapter to the future of science and industry. The work has an abundance of illustrations, including 9 portraits.

C. A. K.

Osiris. Studies on the history of mathematics and the history of science. I. The DAVID EUGENE SMITH presentation volume. 777 p. Bruges, St. Catherine Press, 1936. ISIS

Reviewed by U. G. MITCHELL, *Scripta mathematica* 5, 126-28, 1938.

Sarton, George. Fifty-second Critical Bibliography of the history and philosophy of science and of the history of civilization (to end of October 1937—with special reference to chemistry, technology and the biological sciences). *Isis* 28, 541-616, 1938. ISIS

"This fifty-second Bibliography contains about 445 items of which 130 deal with chemistry, technology and the biological sciences. They have been kindly contributed by nine scholars belonging to five countries."

17.—ORGANIZATION OF SCIENCE

Internal organization is meant, see Isis 1, 195. *For external organization, national or international, see section* 55)

Cattell, R. B.; Cohen, J.; Travers, R. M. W. Human affairs. IX+360 p. New York, MACMILLAN, 1937. ISIS

Reviewed by M. F. ASHLEY-MONTAGU, *Isis* 28, 508-10, 1938.

Dewey, John. Unity of science as a social problem. *International encyclopedia of unified science* 1, no. 1, 29-38, 1938. ISIS

Harding, T. Swann. Science at the tower of Babel. *Philosophy of science* 5, 338-53, 1938. ISIS

Merton, Robert K. Science and the social order. *Philosophy of science* 5, 321-37, 1938. ISIS

18. — PHILOSOPHY OF SCIENCE

Bohr, Niels. Analysis and synthesis in science. *International encyclopedia of unified science* 1, no. 1, 28, 1938. ISIS

Boodin, John Elof. A revolution in metaphysics and in science. *Philosophy of science* 5, 267-75, 1938. ISIS

Bridgman, P. W. Operational analysis. *Philosophy of science* 5, 114-31, 1938. ISIS

International encyclopedia of unified science. Editor-in-chief, OTTO NEURATH. Associate editors, RUDOLF CARNAP, CHARLES W. MORRIS. Vol. I, nos. 1 and 2. VIII+75 p.; VII+59 p. University of Chicago Press, 1938. ISIS

This international encyclopedia which has been carefully prepared for a long time is now beginning to appear. Two parts of vol. I, Foundations of the unity of science, are now available. Every part will be analyzed in the Critical Bibliography of *Isis* and a general review will eventually be published when more parts have been published. Our very good wish to this great and useful undertaking. G. S.

Lepley, Ray. The verifiability of facts and values. *Philosophy of science* 5, 310-20, 1938. ISIS

Morris, Charles W. Foundations of the theory of signs. *International encyclopedia of unified science* 1, no. 2, 1-59, 1938. ISIS

Morris, Charles W. Scientific empiricism. *International encyclopedia of unified science* 1, no. 1, 63-75, 1938. ISIS

Neurath, Otto. Unified science as encyclopedic integration. *International encyclopedia of unified science* 1, no. 1, 1-27, 1938. ISIS

Northrop, F. S. C. Causality in field physics in its bearing upon biological causation. *Philosophy of science* 5, 166-80, 1938. ISIS

Prescott, C. H., jr. The scientific method and its extension to systems of many degrees of freedom. *Philosophy of science* 5, 237-66, 1938. ISIS

Seares, Frederick H. The concept of uniformity, growth and reactions. 50 p. (Elihu Root Lectures of Carnegie Institution of Washington on The influence of science and research on current thought). Washington, 1938. ISIS

Urban, Wilbur M. Symbolism in science and philosophy. *Philosophy of science* 5, 276-99, 1938. ISIS

Vivas, Eliseo. Nature, common sense and science. *Philosophy of science* 5, 300-09, 1938. ISIS

II. — FORMAL SCIENCES (Knowledge of forms)

19. — LOGIC AND THEORY OF KNOWLEDGE

Carnap, Rudolf. Logical foundations of the unity of science. *International encyclopedia of unified science* 1, no. 1, 42-62, 1938. ISIS

Nagel, Ernest. Some theses in the philosophy of logic. *Philosophy of science* 5, 46-51, 1938. ISIS

Russell, Bertrand. On the importance of the logical form. *International encyclopedia of unified science* 1, no. 1, 39-41, 1938. ISIS

20. — MATHEMATICS

Bell, Eric Temple. Men of mathematics. XXI+592 p., 29 ills. New York, SIMON and SCHUSTER, 1937. ISIS

Reviewed by GEORGE SARTON, *Isis* 28, 510-13, 1938.

Cavallaro, Vincenzo G. Osservazioni sull'articolo " Géométrie du triangle " del " Traité de géométrie " di E. ROUCHÉ e CH. DE COMBEROUSSE. *Il bollettino di matematica* 34, XXXVI-XXXVIII, 1938. ISIS

Denjoy, Arnaud. Aspects actuels de la pensée mathématique. *Annales de l'Université de Paris* 13, 151-63, 1938. ISIS

Ionides, S. A. Multiplication is vexation but 'rithmetic was also hated 2,000 years ago. *Engineers' bulletin*, 2 p., May 1938. ISIS

Ionides, S. A. Division is as bad. *Engineers' bulletin*, 2 p., July 1938. ISIS

III. — PHYSICAL SCIENCES (Knowledge of inorganic nature)

22. — MECHANICS (*Including celestial and atomical mechanics*)

Filon, L. N. G. Mass and force in Newtonian mechanics. *Mathematical gazette* 22, 9-16, 1938. ISIS

Skulsky, Samuel. A theory of time. *Philosophy of science* 5, 52-9, 1938. ISIS

23. — ASTRONOMY

Bidez, J. Le nom et les origines de nos almanachs. Mélanges Émile Boissacq, p. 77-85, Bruxelles, 1937. ISIS

Heindel, R. Heathcote. Americans and the Royal astronomical society. *Science* 87, 575, 1938. ISIS

Humbert, Pierre. Les premiers essais de nomenclature lunaire. *Sphinx* 93-4, 1938. ISIS

Johnson, Francis R. Astronomical thought in Renaissance England. A study of the English scientific writings from 1500 to 1645. XI+357 p. Baltimore, Johns Hopkins Press, 1937. ISIS

Reviewed by Grant McColley, *Isis* 28, 514-16, 1938.

Proctor, Mary; Crommelin, A. C. D. Comets. Their nature, origin, and place in the science of astronomy. XI+204 p. London, Technical Press, 1937. ISIS

Reviewed by C. Doris Hellman, *Isis* 28, 513-14, 1938.

24. — PHYSICS

Crowther, J. G. Famous American men of science. XVI+414 p. New York, NORTON, 1937. ISIS

Reviewed by M. F. ASHLEY-MONTAGU, *Isis* 28, 507-08, 1938.

Crowther, J. G. Men of science. XIII+332 p. New York, NORTON, 1936. ISIS

Reviewed by M. F. ASHLEY-MONTAGU, *Isis* 28, 507-08, 1938.

Gliozzi, Mario. L'elettrologia fine al VOLTA. 2 vols. 290 p.; 233 p. Napoli, LOFFREDO, 1937. ISIS

Reviewed by G. DE SANTILLANA, *Isis* 28, 516-20, 1938.

25. — CHEMISTRY, PHYSICO-CHEMISTRY, INDUSTRIAL CHEMISTRY

Hopkins, Arthur John. A defence of Egyptian alchemy. *Isis* 28, 424-31, 1938. ISIS

Lippmann, Edmund O. von. Some remarks on HERMES and Hermetica. *Ambix* 2, 21-5, 1938. ISIS

Read, John. Alchemy in Scotland. *Chemist and druggist*. 4 p., illus., June 25, 1938. ISIS

26. — TECHNOLOGY

(*For mining, see* 32. *geology; for industrial chemistry,* 25. *chemistry. See also Arts and crafts under* 45).

Arnold, Gerhard. Zeittafel zui Geschichte des Kraftwagens. *Technikgeschichte* 23, 113-17, 1934. ISIS

Bacon, Frederic. Aus der Geschichte des englischen Schiffbaues. Deutsch von LOTTE MATSCHOSS. *Technikgeschichte* 26, 71-83, 1937. ISIS

Born, Erhard. Zur Entwicklungsgeschichte des Eisenbahnsignalwesens. *Technikgeschichte* 24, 89-100, 2 fig., 1935. ISIS

Boyne, Rolf. Vom Entwicklungsgang der Abwasserbeseitigung in den letzten hundert Jahren. *Technikgeschichte* 25, 57-65, 3 pl., 5 fig., 1936. ISIS

Conradis, Heinz. Alte Baggermaschinen. *Technikgeschichte* 26, 51-61, 2 pl., 11 fig., 1937. ISIS

Croon, Ludwig. Aus der Geschichte des Fahrrades. *Technikgeschichte* 23, 62-9, 2 pl., 1934. ISIS

Dickinson, H. W. Alte Strassen und Pflasterungen in London. *Technikgeschichte* 23, 45-50, 2 pl., 1934. ISIS

Erbach, R. Die geschichtliche Entwicklung der Kampfmittel zur See. *Technikgeschichte* 26, 15-36, 8 pl., 17 fig., 1937. ISIS

Feuchtinger, Max-Erich. 100 Jahre Wettbewerb zwischen Eisenbahn und Landstrasse. *Technikgeschichte* 24, 101-08, 5 fig., 1935. ISIS

Forbes, R. J. Bibliography of road building circa 300-1840. *Roads, road construction* June 1, 1938, 8 p. ISIS

"Approximately 600 titles of publications pertaining to the history of roadmaking are assembled in this bibliography. There are in the first place a number of additions to the literature cited by the writer in an earlier publication, 'Ancient roads and their construction' (Amsterdam, 1934), dealing with the history of roadmaking in antiquity. Secondly, it itemizes the principal publications on the subject of roadmaking covering the period from the fall of the Roman Empire to the death of MacAdam and the advent of the railways. Special mention should be made of the second group of publications covering the period of, roughly, from A. D. 300 to 1840. Of necessity, some of the titles had to be given without full details as to place and date of issue, as the original documents were not accessible to the writer. They were, however, included where mention of them in other publications made it plain that they are important to a proper understanding of this subject."

Gromodka, Oskar; Müller, Rudolf. Über Wagen und Wagenbau. *Technikgeschichte* 23, 70-8, 2 pl., 14 fig., 1934. ISIS

Gutsche, Fritz. Die Entwicklung der Schiffsschraube. *Technikgeschichte* 26, 37-50, 2 pl., 16 fig., 1937. ISIS

Hassler, Fr. Aus der Geschichte der Kampfwagen. *Technikgeschichte* 23, 99-112, 2 pl., 3 fig., 1934. ISIS

Hertwig, A. Die Eisenbahn und das Bauwesen. *Technikgeschichte* 24, 29-37, 6 pl., 1935. ISIS

Hertwig, A. Aus der Geschichte der Strassenbautechnik. *Technikgeschichte* 23, 1-5, 7 fig., 1934. ISIS

Hertwig, A. Aus der Geschichte der Gewölbe—Ein Beitrag zur Kulturgeschichte. *Technikgeschichte* 23, 86-93, 4 pl., 8 fig., 1934. ISIS

Höhler, Fritz. Germanischer Schiffbau. *Technikgeshichte* 26, 1-14, 8 fig., 1937. ISIS

Horwitz, Hugo Th. Über urtümliche Seil-, Ketten- und Seilbahnbrücken. *Technikgeschichte* 23, 94-8, 1934. ISIS

Jackson, Dugald C. Engineering's part in the development of civilization. *Mechanical engineering* 60, 529-34, 1938. ISIS

" First of a series of six lectures on this subject delivered at the University of North Carolina state college of agriculture and engineering, Raleigh, N. C., Jan. 21 to 29, 1938."

Körting, A. Geschichte der Gastechnik. *Technikgeschichte* 25, 84-110, 2 pl., 10 fig., 1936. ISIS

Körting, Johannes. Aus der Geschichte der Zentralheizung bis zur Gegenwart. *Technikgeschichte* 26, 115-29, 2 pl., 27 fig., 1937. ISIS

Mahr, Otto. Aus der Geschichte der Eisenbahnräder. *Technikgeschichte* 24, 83-8, 1935. ISIS

Mahr, Otto. Zeittafel zur Geschichte der Eisenbahnen, besonders in Deutschland. *Technikgeschichte* 24, 109-15, 2 pl., 1935. ISIS

Mahr, Otto. Zur Geschichte des Wagenrades. *Technikgeschichte* 23, 51-61, 11 fig., 1934. ISIS

Matschoss, Conrad. Hundert Jahre deutsche Eisenbahn. *Technikgeschichte* 24, 1-22, 4 pl., 14 fig., 1935. ISIS

Meldau, Robert. Hauptwurzeln des deutschen Patentrechts. *Technikgeschichte* 26, 107-14, 1937. ISIS

Metzeltin, E. Geschichte der Normung im Eisenbahnwesen. *Technikgeschichte* 24, 62-70, 2 pl., 3 fig., 1935. ISIS

Metzeltin, E. Zur Geschichte der Druckluftlokomotive. *Technikgeschichte* 24, 77-82, 2 pl., 1935. ISIS

Meyer, P. Grosse Leistungen holländischer Ingenieure. *Technikgeschichte* 26, 84-92, 2 pl., 7 fig., 1937. ISIS

Penrose, Charles. 1838, April fourth, 1938. A century of Atlantic steam navigation. 31 p. Newcomen Society, American branch, 1938. ISIS

Sbrzesny, Walter. Lehrer und Gestalter im deutschen Wasserbau. *Technikgeschichte* 26, 62-70, 2 pl., 1937. ISIS

Schulze, Berthold. Geschichtliches über das Norddeutsche Strassenwesen. *Technikgeschichte* 23, 30-5, 2 pl., 1934. ISIS

Schwarze, Bruno. Die theoretische Aus- und Fortbildung bei den deutschen Eisenbahnen. Ein geschichtlicher Abriss. *Technikgeschichte* 24, 71-6, 1935. ISIS

Szymanski, Hans. Zeittafel zur Geschichte des Handelsschiffes. *Technikgeschichte* 26, 93-106, 1937. ISIS

Ude, Hans. Zur Geschichte der Eisenbahnwerkstoffe. *Technikgeschichte* 24, 38-61, 2 pl., 13 fig., 1935. ISIS

Wahl, Karl. Entwicklung der Wasserversorgung seit Einführung der Dampfmaschine. *Technikgeschichte* 25, 26-42, 2 pl., 1 fig., 1936. ISIS

IV. — BIOLOGICAL SCIENCES (Knowledge of organic nature)

27. — BIOLOGY (*generalities, " natural history "*)

Bizzarrini, Giotto. Gl' innesti animali e la loro distinzione secondo GIRARD. Alcune osservazioni su quanto scrive VORONOFF. Innesti eteroplastici praticati da PAOLO MANTEGAZZA. Anche DIACINTO CESTONI esperimentò innesti animali. *Rivista di storia delle scienze mediche e naturali* 29, 148-52, 1938. ISIS

Goldschmidt, Richard. Ascaris, The biologist's story of life. IX+ 390 p. New York, PRENTICE-HALL, 1937 ($ 3.25). ISIS

Professor GOLDSCHMIDT is the world's most distinguished physiological geneticist whose work is known to every biologist; a popularly written book on biology from his pen is therefore a very welcome surprise. The reviewer has read many scores of books on biology of a similar kind, but never one so originally conceived or so interestingly written. It is a masterpiece of popular scientific writing. M. F. A.-M.

Reed, H. S.; Dufrénoy, J. La croissance phénomène autocatalytique. *Revue générale des sciences* 45, 565-69, 1934. ISIS

28. — BOTANY

(*Agronomy, phytopathology, palaeobotany*)

Borza, Al.; Butură, Valeriu. Bäuerliche Pflanzenheilmittel in der Moldau (Rumänien). *Archiv für Geschichte der Medizin* 31, 81-6, 1938. ISIS

Glock, Waldo. Principles and methods of tree-ring analysis. (Carnegie Institution of Washington publication no. 486). Washington, 1937. ISIS

A detailed, technical exposition of the methods of dating the annual rings in trees, showing, among other things, how it is possible to date exactly the saplings used in the prehistoric pueblo villages in our Southwestern states. C. Z.

Horlbeck, Else. Die Salbei (Salvia officinalis L.). Ein Beitrag zu der Geschichte ihrer Verwendung in Deutschland vom Jahre 800 ab. 37 p. (*Institut f. Geschichte der Medizin*). Eisfeld i. Thür., 1937. ISIS

Messedaglia, Luigi. Per la storia delle nostre piante alimentari, il riso. *Rivista di storia delle scienze mediche e naturali* 29, 49-64, 1938 (end). ISIS

Ruegg, Kurt. Beiträge zur Geschichte der offizinellen Drogen (Crocus, Acorus Calamus und Colchicum). Inaugural-Dissertation. 316 p. Basel, 1936. ISIS

Contains a very complete list of the references to these drugs in classical, Arabic, and medieval literature; also, an excellent bibliography. C. Z.

29. — ZOOLOGY

Lillie, Frank R. Zoological sciences in the future. *Science* 88, 65-72, 1938. ISIS

Address before the American Association for the Advancement of Science in the conference on science and society, Ottawa, June 28, 1938.

Sayles, Leonard P. Manual for comparative anatomy. XI+214 p., 55 fig. New York, MACMILLAN, 1938 ($ 1.60). ISIS

This is a note book for the dissecting room, with summaries and drawings directing the student's attention to the parts to be observed. The arrangement is very convenient, and the handiness of the book is increased by the type of binding (wire-o binding). G. S.

Woodruff, Lorande Loss. Animal biology. XIV+535 p. New York, MACMILLAN, 1938 ($ 3.75). ISIS

The second revised and greatly enlarged edition of one of the best textbooks in animal biology. A very excellent and most unusual feature in a book of this kind is a final chapter on the development of biology.
M. F. A.-M.

V. — SCIENCES OF THE EARTH

(implying knowledge of both organic and inorganic nature)

31. — GEOGRAPHY AND OCEANOGRAPHY

Grundy, G. B. The old English mile and the Gallic league. *Geographical journal* 91, 251-59, 1938. ISIS

Imago mundi. A periodical review of early cartography, edited by LEO BAGROW and EDWARD LYNAM, part II. 112 p. London, STEVENS and STILES, 1937. ISIS

Reviewed by E. HEAWOOD, *Geographical journal* 91, 83-5, 1938. "The first part of this publication appeared in 1935. The venture was a somewhat bold one, and soon met with a serious contretemps through the departure from Germany of Mr. WERTHEIM, its publisher; for though intended to be international, it was domiciled in Germany, its editor being L. BAGROW of Berlin. After some delay the difficulty has been successfully overcome, the firm of HENRY STEVENS having undertaken publication in London, while a competent associate editor has been found in Mr. LYNAM of the British Museum." The volumes of *Imago mundi* are analyzed in *Isis* as they appear.
C. W. A.

Lubbock, Basil. The arctic whalers. XII+484 p. Glasgow, BROWN Son and FERGUSON, 1937. ISIS

Reviewed by G. C. L. BERTRAM, *Geographical journal* 91, 188-89, 1938.

33. — METEOROLOGY, CLIMATOLOGY AND TERRESTRIAL PHYSICS

Britton, C. E. A meteorological chronology to A. D. 1450. 178 p., folio. (Meteorological office, *Geophysical memoirs* no. 70, first number, vol. 8). London, His Majesty's Stationery Office, 1937. ISIS

Reviewed by GEORGE SARTON, *Isis* 28, 520-22, 1938.

VI. — ANTHROPOLOGICAL AND HISTORICAL SCIENCES

(Knowledge of man, past and present)

34. — ANATOMY

Barbosa Sueiro, M. B. La rénovation de l'étude de l'anatomie humaine aux XIII^e^, XIV^e^ et XV^e^ siècles. *Arquivo de anatomia e antropologia* 18, 175-99, 1937. ISIS

36. — PHYSIOLOGY (*human and comparative*)

Eulenburg-Wiener, Renée von. Fearfully and wonderfully made. XII+472 p. New York, MACMILLAN, 1938 ($ 5.00). ISIS

A book of great value on the human organism by a biochemist. Practically every relevant branch of modern science is brought in to bear upon the problems discussed with the result that the book is one of the best introductions to the study of the human organism available.

M. F. A.-M.

Luck, J. M.; Noller, C. R. Annual review of biochemistry. Volume VII X+571 p. Stanford University P. O., Calif., Annual Reviews, Inc., 1938 ($ 5.00). ISIS

Annual reviews in the scientific fields differ from abstracting annuals in that they do not cover the entire field, are topical in treatment rather than by authors, and in change of subjects year by year. They suffer from the temporary omission of important fields, the limitations imposed by the size of the volume and limitations of the reviewers' interests and insight. The topical reviewer has, however, exceptional opportunities for the critical assessment of the significance of contributions, the detection of false leads, and correction of errors, and opportunities for critical comparison of con-

tending interpretations on the advance lines of research. Such topical reviews are often of great service not only to specialists in the field but even more to biologists in collateral but interrelated subjects. The seventh volume of this series contains topical reviews on 23 subjects with citations from the papers of more than 3000 investigators. The subjects reviewed are biologiacl oxidations and reductions; crystalline enzymes; carbohydrates and glycosides; acyclic constituents of natural fats and oils; amino acids and proteins; metabolism of compounds of phosphorus, carbohydrates, fat, amino acids and proteins, and creatine and creatinine; acid-base metabolism; vitamin C; fat-soluble vitamins; nutrition; biochemistry of muscle; liver and bile; terpines and saponins; organic insecticides; chemistry of bacteria; and growth regulators in higher plants. C. A. K.

37. — PSYCHOLOGY (*human and comparative*)

Rhine, J. B. New frontiers of the mind. 275 p. New York, FARRAR & RINEHART, 1937. ISIS

Reviewed by M. F. ASHLEY-MONTAGU, *Isis* 28, 531-34, 1938.

39. — PREHISTORY

Sarton, George. Prehistoric arithmetic in Vestonice. *Isis* 28, 462, 1938. ISIS

Stéphen-Chauvet. La médecine chez les peuples primitifs (préhistoriques et contemporains). XXIII+143 p., 103 fig. (*La médecine à travers le temps et l'espace*, no. 1). Paris, MALOINE, 1936. ISIS

40. — ETHNOLOGY

(*Primitive and popular science*)

Fettweis, Ewald. Völkerkundliche Beiträge zur Frage nach der Entstehung der Messkunde. *Technikgeschichte* 26, 130-38, 1937. ISIS

Hulme, E. Wyndham. Prehistoric and primitive iron smelting. *Engineering* 4 p., June 3, 1938. ISIS

41. — SUPERSTITION AND OCCULTISM

Forman, Henry James. The story of prophecy in the life of mankind from early times to the present day. XI+347 p., 14 illus. New York, FARRAR & RINEHART, 1936. ISIS

" Growing as the present book does out of a personal interest in prophecy,

a sort of hobby, the reader, it is hoped, may possibly share with the author some of the pleasurable surprise he experienced in many a curious and arresting discovery, but notably in this one : Not only were critical times in the past the objects of often strikingly correct prophesying before the event, but even our own crucial period, through which we are now passing, has been long foretold, with considerable detail, by a very chorus of voices crying in the wilderness. Our immediate present and future, it would appear, have been the concern of ages of seers, and if events have taken us unawares, it is owing largely, as any student of prophecy can demonstrate, to our own perversity and blindness. Prophecy, in short, a persisting human inheritance, would seem to fare somewhat like the laws of nature, systematically neglected until the critical time, to mankind's incalculable cost. If the future, as some hold, is the only reality, it can hardly be other than our most prized possession. To present this outline of prophecy, therefore, laying claim neither to profound scholarship nor encyclopedic exhaustiveness, appears to require no apology upon the part of the writer, but rather indulgence on the reader's part for what has inevitably been omitted."

Contents (p. stands for prophecy, ps. for prophecies) : 1. What is p.?; 2. Something about oracles; 3. The great pyramid speaks; 4. Peoples touched by pyramid p.; 5. The end of the age : biblical p.; 6. Of medieval p.; 7. Astrologers and saints; 8. Ps. concerning the popes; 9. The ps. of NOSTRADAMUS; 10. Europe's greatest prophet; 11. Mother SHIPTON, second-sight, and Scotch seers; 12. Some noted German ps.; 13. Foretelling the French Revolution; 14. The great war in p.; 15. Ps. of our own times; 16. More recent ps.; 17. America in p.; 18. The prophetic future.

42. — ECONOMICS

(Economic doctrines and history. Commerce. Transportation and communications)

Korzendorfer, Adolf. Post, Poststrassen, Postwagen. *Technikgeschichte* 23, 79-85, 2 pl., 1934. ISIS

Mai, E. Strassen und Strassenfahrzeuge in Afrika. *Technikgeschichte* 23, 118-23, 1 fig., 1934. ISIS

43. — SOCIOLOGY, JURISPRUDENCE AND POSITIVE POLITY

Coker, Francis William. Readings in political philosophy. XVI+ 717 p. New York, MACMILLAN, 1938 ($ 4.00). ISIS

This is the second revised and enlarged edition of a very valuable work first published in 1914 bringing together the source material, from PLATO to BENTHAM, on political philosophy. It would be a very excellent thing if, in addition, we would have a similar volume of readings in political philosophy from BENTHAM to the present time, from BENTHAM let us say to MUSSOLINI and HITLER ! M. F. A.-M.

Sellin, Thorsten. Culture conflict and crime. A report of the subcommittee on delinquency of the Committee on personality and culture. IX+116 p. (Bulletin, 41). New York, Social science research council, 1938. ISIS

44. — HISTORY OF CIVILIZATION

(General history, historical methods, biography and chronology)

Biographie nationale publiée par l'Académie royale de Belgique. Tome 26, 2e fascicule, Bruxelles, 1937-1938. ISIS

Ce nouveau fascicule (fin de la lettre V) de la Biographie nationale, qui a commencé à paraître en 1866, contient de nombreuses notices consacrées à des savants et à des médecins, parmi lesquels nous mentionnerons notamment : VARLEZ, VELDEN (VAN), VENNEMAN, VERBEECK, VERBIEST, VERHAEGHE, VERHEYEN, VERHULST, VÉSALE, VOTTEM; (add.) : VAN MEERBEEK et VAN MONS. J. P.

Congress of historical sciences (VIIIth, Zurich 1938). *Isis* 28, 466, 1938. ISIS

Lovejoy, Arthur O. The great chain of being. IX+382 p. Cambridge, Mass., Harvard Univ. Press, 1936. ISIS

Reviewed by HENRY V. S. OGDEN, *Isis* 28, 537-40, 1938.

Marvin, F. S. Unity schools. Farnham meeting, 1937. *Isis* 28, 465, 1938. ISIS

VII. — MEDICINE

50. — HISTORY, ORGANIZATION, AND PHILOSOPHY OF MEDICINE

Abbott, Maude E. History of medicine in the province of Quebec. 100 p., 41 ills. Montreal, McGill University, 1931. ISIS

Artelt, Walter. "Zahnheilkunde." Versuch einer historischen Analyse ihres Wesens. Aus dem Institut für Geschichte der Medizin und der Naturwissenschaften der Universität Berlin. *Zahnärztliche Mitteilungen* 24, 11 p., 1933. ISIS

Bader, Alfred. Entwicklung der Augenheilkunde im 18. und 19. Jahrhundert mit besonderer Berücksichtigung der Schweiz (Nachlass

von Prof. HORNER, Zürich). 34 ills., 10 facs. Basel, SCHWABE, 1933. ISIS

Ballenger, Edgar Garrison; Frontz, William A.; Hamer, Homer G.; Lewis, Bransford. History of urology. 2 vols. XII+386 p.; VII+362 p., 58 fig. Baltimore, WILLIAMS and WILKINS, 1933. ISIS

Bessim Omer. Dogum Tarihi (L'histoire de l'obstétrique). 56 p., illus. Istanbul, IHSAN, 1932. ISIS

Reviewed by A. ADNAN, *Archeion* 14, 335-37, 1932.

Bett, Walter, R. Johns Hopkins' graduate week in medical history. *Medical life* 45, 153-60, 1938. ISIS

(Bickerton, Thomas Herbert). A medical history of Liverpool from the earliest days to the year 1920. From the data collected by the late THOMAS H. BICKERTON. XX+313 p. London, MURRAY, 1936. ISIS

Bon, Henri. Précis de médicine cətholique. XII+768 p. Paris, ALCAN, 1935. ISIS

Bradtmöller, Hans. Die Geschichte der geburtshilflichen Zangen und Hebel, dargestellt an Hand der Instrumentensammlung der Göttinger Universitäts-Frauenklinik. 50 p., 20 pl., figs. (Vorarb. z. Gesch. d. Götting. Univ. u. Bibl. H. 20). Göttingen, VANDENHOECK & RUPRECHT, 1935. ISIS

Breede, Ellen. Studien zu den lateinischen und deutschsprachlichen Totentanztexten des 13. bis 17. Jahrhunderts. 179 p. Halle a. S. NIEMEYER, 1931. ISIS

Casarini, Arturo. I precursori italiani della chirurgia di guerra e GIOVANNI YPERMAN. *Atti e Mem. Acc. ad. Stor. Arte Sanit.* 2, 10-25, 4 fig., 1936. ISIS

Catalogus van de Bibliotheek der nederlandsche maatschappij tot bevordering der geneeskunst. In bruikleen vereenigd met de Bibliotheek der Universiteit van Amsterdam. Amsterdam, Internationaal Antiquariaat, 1930. ISIS

Cornilleau, Robert. La bufothérapie, une médication nouvelle par le venin de crapaud. 61 p. Paris, VIGNÉ, 1938. ISIS

Creutz, Walter. Die Neurologie des 1.-7. Jahrhunderts n. Chr. Eine historisch-neurologische Studie. 106 p. Leipzig, THIEME, 1934. ISIS

Reviewed by DAVID RIESMAN, *Annals of medical history* 8, 181, 1936.

Crummer, Le Roy. The extra-academic origin of medical specialites. *California and West. Med.* 33, 884-86, 1930; 34, 46-9, 1931. ISIS

Introductory lecture in new department of medical history and bibliography, University of California medical school. C. D. L.

Dawson, George Gordon. Healing, pagan and Christian. IX+322 p. London, S. P. C. K., 1935. ISIS

Dawson, Warren R. Manuscripta medica. A descriptive catalogue of the manuscripts in the Library of the Medical Society of London. London, BALE, Sons & DANIELSSON, 1932. ISIS

Delaunay, Paul. Les chirurgiens du Haut-Maine sous l'Ancien régime. 176 p. Le Mans, MONNOYER, 1937. ISIS

Delaunay, Paul. Mélanges médico-historiques. 90 p. Le Mans, MONNOYER, 1937. ISIS

Del Guerra, G. Introduzione allo studio della storia della medicina. 93 p. Pisa, GIARDINI, 1934. ISIS

Dumesnil, René. Histoire illustrée de la médecine. 265 p., ills., Paris, PLON, 1935. ISIS

Exhibition of the earliest medical periodicals printed in the United States. *Annals of medical history* 10, 274-75, 1938. ISIS

Findley, Palmer. The story of childbirth. XX+376 p. Garden City, N. Y., DOUBLEDAY, DORAN, 1933. ISIS

Reviewed in *Annals of medical history* 6, 190, 1934.

Fishbein, Morris. Frontiers of medicine. X+207 p. Baltimore, WILLIAMS & WILKINS, 1933. ISIS

Fleury, Maurice de. Le médecin. 126 p. Paris, HACHETTE, 1927. ISIS

Fourmestraux, I. de. Histoire de la chirurgie française (1790-1920). Préface de J. L. FAURE. 232 p. Paris, MASSON, 1934. ISIS

García del Real, Eduardo. Historia contemporanea de la medicina. 644 p. Madrid, ESPASA-CALPE, 1934. ISIS

García del Real, Eduardo. Trabajos de la Cátedra de historia crítica de la medicina. Tomo I, 596 p. y varias láminas fuero de texto. Madrid, Imprenta de los sobrinos de la sucesora de M. MUESA, 1933. ISIS

Haberling, Wilhelm. German medicine. Transl. by JULES FREUND. XIII+160 p., 9 fig. (Clio med., 13). New York, HOEBER, 1934. ISIS

Haggard, Howard Wilcox. The doctor in history. New Haven, Yale University Press, 1934. ISIS

Haggard, Howard Wilcox. Mystery, magic and medicine. The rise of medicine from superstition to science. Garden City, N. Y., DOUBLEDAY, DORAN, 1933. ISIS

Haggard, Howard Wilcox. The lame, the halt, and the blind. The vital role of medicine in the history of civilization. XXIV+420 p. London, HEINEMAN, 1932. ISIS

Heischkel, E. Die Strasse in der Geschichte der Medizin. *Technikgeschichte* 23, 36-44, 3 fig., 1934. ISIS

Hutchison, Robert; Wauchope, G. M. For and against doctors: an anthology. 168 p. London, ARNOLD, 1935. ISIS

Reviewed in *Nature* 137, 764, 1936.

James, R. Rutson. Studies in the history of ophthalmology in England prior to the year 1800. X+255 p., 9 pl. Cambridge University Press, 1933. ISIS

Jameson, Edwin Milton. Gynecology and obstetrics. XV+170 p., 5 ills. (Clio medica 17). New York, HOEBER, 1936. ISIS

Reviewed by WILLIAM R. NICHOLSON, *Annals of medical history* 9, 95-6, 1937.

Jarcho, Julius. Postures and practices during labor among primitive peoples, adaptations to modern obstetrics, with chapters on taboos and superstitions, and post-partum gymnastics. XVI+175 p., 130 ills. New York, HOEBER, 1934. ISIS

Reviewed in *Annals of medical history* 6, 560, 1934.

Kallmorgen, Wilhelm. Siebenhundert Jahre Heilkunde in Frankfurt am Main. XVI+485 p., ill., 17 pl. Frankfurt a. M., DIESTERWEG, 1937. ISIS

Krumbhaar, Edward Bell. Pathology. XVII+206 p., 17 ills. New York, HOEBER, 1937. ISIS

Reviewed in *Annals of medical history* 9, 512, 1937.

Laignel-Lavastine, Histoire générale de la médecine, de la pharmacie, de l'art dentaire et de l'art vétérinaire, ornée de nombreuses illustrations. Tome I, 681 p., fig. Paris, MICHEL, 1936. ISIS

Laignel-Lavastine. Le VIII[e] Congrès international d'histoire de la médecine (Rome). *Aesculape* 21, 225-48, 31 fig., 1931. ISIS

Laurentius, Paul. Geschichte der Krankenbehandlung mittels Elektrizität. 95 p. (A. d. Inst. f. Gesch. d. Med. an d. Med. Akad. Düsseldorf, HABERLING). Diss. Düsseldorf, 1936. ISIS

Leake, Chauncey D. A note on the medical books of famous printers. *California and West. Med.* 32, 36-40, 106-10, 1930. ISIS

Lefanu, W. R. British periodicals of medicine, a chronological list. Part II : 1900-1938. *Bulletin of the institute of the history of medicine* 6, 614-48, 1938. ISIS

Lindsay, Lilian. A short history of dentistry. 88 p. London, BALE, Sons and DANIELSSON, 1933. ISIS

Loebel, Josef. Medicine : a voyage of discovery. Translated from the German by L. MARIE SIEVEKING and JAN F. D. MORROW. VII+334 p. New York, FARRAR and RINEHART, 1934. ISIS

Reviewed in *Annals of medical history* 6, 379, 1934.

Loebel, Josef. Whither medicine? XI+296 p. London, SIDGWICK and JACKSON, 1934. ISIS

Mercier, Raoul. Histoire de la médecine en Touraine. 53 p. 8 fig. Tours, 1936. ISIS

Reviewed by MARCEL FOSSEYEUX, *Bull. de la soc. franç. d'hist. de la méd.* 34, 315, 1936.

Mercier, Raoul. Le monde médical de Touraine sous la Révolution, avec préface de LOUIS MADELIN. 400 p., ill. Tours, ARRAULT, 1936. ISIS

Reviewed by MARCEL FOSSEYEUX, *Bull. de la soc. franç. d'hist. de la méd.* 34, 316-17, 1936.

Monro, Thomas Kirkpatrick. The physician as man of letters, science and action. VIII+212 p. Glasgow, JACKSON, WYLIE, 1933. ISIS

Moynihan, Lord Berkeley George Andrew. Truants. The story of some who deserted medicine yet triumphed. Based on the Linacre lecture delivered at Cambridge, May 6, 1936. 108 p. Cambridge University Press, 1936. ISIS

Moynihan, Lord Berkeley George Andrew. The advance of medicine. 64 p. Oxford, Clarendon Press, 1932. ISIS

Neuburger, Max. The doctrine of the healing power of nature, throughout the course of time. Transl. by LINN J. BOYD. *J. Amer. inst. of homeopathy*, 184 p., New York, 1932. ISIS

Olpp, G. Hervorragende Tropenärzte in Wort und Bild. 446 p., 71 p., 280 illus. München, GMELIN, 1932. ISIS

Olpp, Gottlieb. Charakterköpfe der Tropenmedizin. 96 p., figs. Berlin, Die Brücke zur Heimat, 1936. ISIS

Pazzini, Adalberto. Metamorfosis. Saggio critico sull'evoluzione dell'etica medica. Dal Codice di HAMMURABI al De Christiana ac tuto medendi ratione. *Riv. stor. sci. med. e natur.* 22, 64-88, 117-53, 1931. ISIS

Polter, Karl-Heinz. Musik als Heilmittel. IV+59 p. (Aus dem Institut für Geschichte der Medizin an der Medizinischen Akademie in Düsseldorf, HABERLING). Düsseldorf, Inaug.-Diss., 1934. ISIS

Power, Sir D'Arcy. British masters of medicine. Baltimore, WOOD, 1936. ISIS

Power, Sir D'Arcy. A short history of surgery. 91 p. London, BALE, Sons and DANIELSSON, 1933. ISIS

Rich, Ida. Einiges vom medizinhistorischen Museum der Universität Kopenhagen. *Archiv für Geschichte der Medizin* 31, 61-76, 1938. ISIS

Rolants, E. Notes sur l'histoire médicale de Lille et de sa région. Le Collège des médecins de Lille, 2e partie, 70 p. Lille, Impr. centrale du Nord, 1933. ISIS

Reviewed in *Bull. de la société franç. d'histoire de la médecine* 28, 255, 1934.

Rolleston, Sir Humphry Davy. The Cambridge medical school : a biographical history. IX+235 p., 21 pl. Cambridge University Press, 1932. ISIS

Rolleston, Sir Humphry. Medical aspects of old age. Being a revised and enlarged edition of the Linacre lecture, 1922. London, MACMILLAN, 1932. ISIS

Saint-Jacques, Eugène. Histoire de la médecine. Coup d'œil à vol d'oiseau. Les grandes époques. Les grandes figures. 223 p. Montréal, BEAUCHEMIN, 1935. ISIS

Schoute, D. Occidental therapeutics in the Netherlands East Indies during three centuries of Netherlands settlement (1600-1900). Publications of the Netherlands Indies public health service. Batavia, KOLFF, 1937. ISIS

Reviewed by B. W. TH. NUYENS, *Bijdragen tot de geschiedenis der geneeskunde* 17, 177-79, 1937.

Schoute, D. De geneeskunde in Nederlandsch-Indie gedurende de negentiende eeuw. 380 p. Batavia, KOLFF, 1935. ISIS

Reviewed by J. BOEKE, *Bijdragen tot de geschiedenis der geneeskunde*, 149-51, 1936.

Semelaigne, René. Les pionniers de la psychiatrie française, avant et après PINEL. 2 vols. 352 p. ; 285 p. Paris, BAILLIÈRE, 1930-32. ISIS

Reviewed by PIERRE BRUNET, *Archeion* 15, 292-94, 1933.

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VIII. — EDUCATION

(the methods of accumulating, imparting and diffusing knowledge)

54. — EDUCATION (*generalities, methods, colleges, universities*)

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Volbehr, Friedrich. Professoren und Dozenten der Christian-Albrechts-Universität zu Kiel 1665 bis 1933 nebst Angaben über die Lektoren, Sprachkursusleiter, Lehrer der Künste und Universitäts-Bibliothekare, sowie über die Rektoren 1665-1933. 3., neubearb. Aufl. v. RICHARD WEYL. XV+319 p., Kiel, MÜHLAU, 1934. ISIS

Reviewed by R. BÜLCK, *DLZ* 5, 2017-19, 1934.

Wagg, Henry John; Thomas, Mary G. A chronological survey of work for the blind (with an appendix on the prevention of blindness, and a bibliography). From the earliest records up to the year 1930. XII+235 p. London, PITMAN, 1932. ISIS

Walker, Thomas Alfred (1862-1935). Peterhouse. XVII+157 p. Cambridge, HEFFER, 1935. ISIS

Whiting, Charles Edwin. The University of Durham, 1832-1932. XIII+345 p. London, Sheldon Press, 1932. ISIS

55. — ACADEMIES, SOCIETIES, CONGRESSES. NATIONAL AND INTERNATIONAL ORGANIZATION OF SCIENCE

(*Societies and congresses devoted to particular sciences are classified under those sciences. For the internal organization of science*—ISIS I, 195—*see section* 17)

Joachim, Johannes. Die Anfänge der Königlichen Sozietät der Wissenschaften zu Göttingen. VIII+105 p. (Abhandlungen der Gesellschaft der Wissenschaften zu Göttingen, Phil.-hist. Kl., 19). Berlin, WEIDMANN, 1936. ISIS

Lacroix, Alfred. Les archives de l'Académie des sciences et l'index biographique de ses membres et correspondants de 1666 à 1937. 7 p. *Comptes rendus des séances de l'Académie des sciences*, séance du 4 janvier 1938. ISIS

56. — BIBLIOGRAPHY (*Methods, libraries*)

De Ricci, Seymour. English collectors of books and manuscripts

(1530-1930) and their marks of ownership. IX+203 p., pl., facs. (Sandars lectures 1929-1930). Cambridge University Press, 1930. ISIS

Reviewed by ERNST CROUS, *DLZ* 4, 1-4, 1933.

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Reviewed by A. H. SHEARER, *American historical review* 39, 166, 1933.

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57. — MUSEOLOGY (*Museums and collections*)

Coleman, Laurence Vail. Historic house museums. XII+187 p. Washington, American association of museums, 1933. ISIS

Reviewed by LEICESTER B. HOLLAND, *American historical review* 40, 133-34, 1934.

Marinus, Albert. L'utilité des petits musées. *Bibliothèque d'études régionales*, no. 31, 447-56, (received April 1938). ISIS

Prashad, B. The Indian museum, Calcutta. *Natural history magazine* 3, 33-8, 1931. ISIS

A history of the museum from 1784 to the present day, by the superintendent of the Zoological Survey of India. C. W. A.

58. — CATALOGUES OF SECOND-HAND BOOKS ON THE HISTORY AND PHILOSOPHY OF SCIENCE

Many catalogues of second-hand books are so interesting and so full of valuable information that we shall henceforth register them in this section, together with other lists of a similar nature, such as catalogues of scientific medals and prints. When applying to the publishers of these catalogues for a copy, please mention *Isis*.

Art ancien. Exact science, from HERO ALEXANDRINUS to PIERRE CURIE. Cat. 22, 122 p., 584 items. Zürich, 8 Pelikanstrasse (received June 1938). ISIS

Davis & Orioli. Rare books, including a large collection of medical books and an appendix of medical and scientific autographs. No. 82, 35 p. London, W. C. 1, 37 Museum St. (received June 1938). ISIS

Degrange, Victor. Autographes, documents et manuscrits, livres anciens et modernes. Catalogue no. 46, 40 p., 1141 items. Paris VI, 91 rue de Seine, 1938. ISIS

Fock, Gustav. Mineralogie, Petrographie, Lagerstättenkunde. Antiquariatskatalog Nr. 721, 92 p., 2496 items. Leipzig C 1, Sternwartenstr. 8, 1938. ISIS

Goldschmidt, E. P. The revival of learning, European scholarship in the XVth and the XVIth centuries. Cat. 49, 73 p., 258 items. London W. 1, 45 Old Bond St. (received June 1938). ISIS

Hoosier Bookshop. American medicine. List 63, 162 items. Indianapolis, Ind., 2135 North Alabama (received July 1938). ISIS

Hoosier Bookshop. Books of various kinds, good, bad and indifferent. Americana, biography, first editions, medicine & science, sets & fine binding, miscellaneous, List no. 62, 207 items. Indianapolis, Indiana, 2135 North Alabama (received June 1938). ISIS

Lambert, Pierre. Livres anciens, rares ou curieux, littérature, histoire, voyages, beaux-arts, etc. 2e partie : Livres, plaquettes rares, documents pour servir à l'histoire des sciences. Catalogue 23, 48 p., 628 items. Paris, VI, Chez Durtal, 12 rue Jacob, 1938. ISIS

Levin & Munksgaard. Iceland-Greenland, the Faroe Islands, Saga-Edda, Arctica - nautica. Catalogue 28, 185 p., 2450 items. Copenhagen, Norregade 6 (received June 1938). ISIS

Lier, R. Old medicine and science. 167 items. Galluzzo (Firenze), Via S. Felice a Ema 33, 1938. ISIS

(**Nourry, Émile**). Médecine ancienne, anatomie-chirurgie, chimie et alchimie, sciences anciennes. No 66, 87 p., 1043 items. Paris Ve, 62, rue des Écoles, 1938. ISIS

Quaritch, Bernard. English and European history and literature. Natural history, including books from the library of the late Baron Bouck, Early medicine and surgery from the library of Sion College, Exact and applied sciences, No. 551, 88 p. London, W. 1, 11 Grafton St., New Bond St., 1938. ISIS

Rosenthal, Jacques. Old atlases, maps, charts, views, broadsides. Catalogue 96, 74 p., 876 items. Munich, 13, Konradstrasse 16, 1938. ISIS

Schwarz, Ignaz. Medizin des 16.-20. Jahrhunderts zumeist Homöopathie und Naturheilkunde, Porträts. Katalog 24, 46 p., 1132 items. Wien I, Tuchlauben 11 (received June 1938). ISIS

59. — MEMORIA TECHNICA

Critical bibliography no. 55. *Isis*, vol. 30, 1939. ISIS

This note is published at the end of our bibliography solely for the convenience of the scholars who cut out the whole or part of it, attach extracts to catalogue cards and classify them. By adding this note to the others they will be able to find out rapidly whether this particular bibliography bas been analyzed or not.

Isis no. 77 (vol. 28, 2). Bruges, 1938. ISIS

This no. is analyzed in the 55th Critical Bibliography. Every previous number has been analyzed in previous bibliographies. G. S.

60. — ERRATA

Si quis Argi oculos habere posset eosque omnes diligentissime ac accuratissime intenderet in singulos versus, multa tamen eum inter corrigendum effugerent.

Isis

Vol. 15, 592. Lowe, J. E., XIII, 484.
28, 63, l. 13. For " that which is past," read " the self."
76, Cuts should be interchanged.
411, l. 1. Printed in parts during the years 1883-95, and in a volume in 1896 (only a few pages were actually reprinted).

411, l. 4 from bottom. Mr. DINSMORE is not simply living at the American Colony in Jerusalem, but is a member of it.

553, l. 2 from bottom. Read WALLIS' for Walli's.

Osiris

Vol. 3, 185, l. 2. For 1522 read 1631.

A few other misprints are not mentioned in these errata because they are too obvious to cause any error or confusion. I wish to express my thankfulness to the readers who take the trouble to make the above-mentioned corrections in their set of *Isis* and the *Introduction*. I would advise them, after having accomplished that little task, to write their initials near mine at the bottom of this note to indicate that these and previous errata have been taken into account. G. S.

These and the previous errata have been corrected by .....

Index of Authors Included in the Fifty-fifth Bibliography

The Roman figures followed by (1) or (2) refer to the centurial classification (Part I); thus Adontz, N., V(1) means that a paper by Adontz is listed under fifth century, first half.

The Arabic figures refer to the historical and to the systematic classifications (Parts II and III) which are subdivided in sections numbered consecutively from 1 to 60. For instance, Ehlers, G., 6 indicates that a paper by Ehlers is listed in section 6 (Middle Ages); Arnold, G., 26 indicates that a paper by Arnold is listed in section 26 (Technology).

The symbols IV(a), IV(b), and IV(c) refer to the new sections on America, Oceania, and Africa at the end of Part II. For instance, Cline. W. IV(c) indicates that a paper by Cline is listed in section IV(c), Africa,

August 17, 1938. FRANCES SIEGEL.

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